

NORTH-SOUTH CENTRE

Research for Development

Annual Report 2011



ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich



North-South Centre
Research for Development

Vision for the ETH Zurich

The ETH Zurich is a leading institution on North-South matters in its field. It has a long-term commitment to research and education in support of globally accessible knowledge for sustainable development.

Mission of the North-South Centre

The North-South Centre promotes research and education in the field of international development and cooperation. It facilitates collaboration with relevant institutions in developing countries, emerging economies and Switzerland in the technical, natural, human and social sciences. These activities are visible nationally and internationally.

Goals

- The North-South Centre promotes long-term research collaboration with partners in developing countries and emerging economies placing emphasis on both interdisciplinary research projects and the link to capacity development.
- The North-South Centre supports students from developing countries and emerging economies at the Master of Science, doctoral and post-doc levels as well as ETH students interested in topics relevant to development.
- The North-South Centre establishes and maintains contacts among its members, within the ETH Zurich and in national and international networks. In Switzerland and beyond, the North-South Centre aims to be recognised as the focal point of the ETH Zurich in all affairs that involve developing countries and emerging economies.

Editorial

This is my last editorial as President of the North-South Centre. In fact, this is the last Annual Report of the North-South Centre as you know it. As of August, the Centre will be merged with International Institutional Affairs to the new unit “ETH Global”. What started out as a competence centre, a typical bottom-up institution within ETH Zurich, will become a service centre of the central administration. This is good for the ETH Zurich and it is necessary for the continuation of the North-South Centre’s work in the future.

There are two main reasons why the competence centre cannot continue in its present form. One is the rule that competence centres have to become financially self-supporting by the end of an initial five-year period. This was not feasible for the North-South Centre, which is not related to an industry with funds. Second, the Swiss Agency for Development and Cooperation (SDC) is shifting its funds for research to the Swiss National Science Foundation (SNSF) to which every ETH researcher can apply directly, making the intermediate role of the North-South Centre redundant.

Still, some of you may worry whether a top-down approach can ever replace a bottom-up initiative. My answer is that the bottom-up initiative can make good use of the new administrative unit. A service unit can only be efficient if people request this service, and if their enthusiasm gives life to what initially is just an administrative structure.

Looking back, I am proud of what the North-South Centre has been offering in the past. Here are some highlights:

- We provided seed money and advice for starting cooperation with partners in developing countries.
- We procured scholarships and doctoral grants (funded by SDC and private foundations).
- We were the entry point of SDC into the ETH Zurich, mainly in agricultural science and natural resources management.
- We organised numerous events such as conferences,

workshops and exhibitions which were very well received by the ETH community and people outside.

- We initiated (and will continue to organise) a yearly colloquium which is open to doctoral students working on subjects related to developing countries.

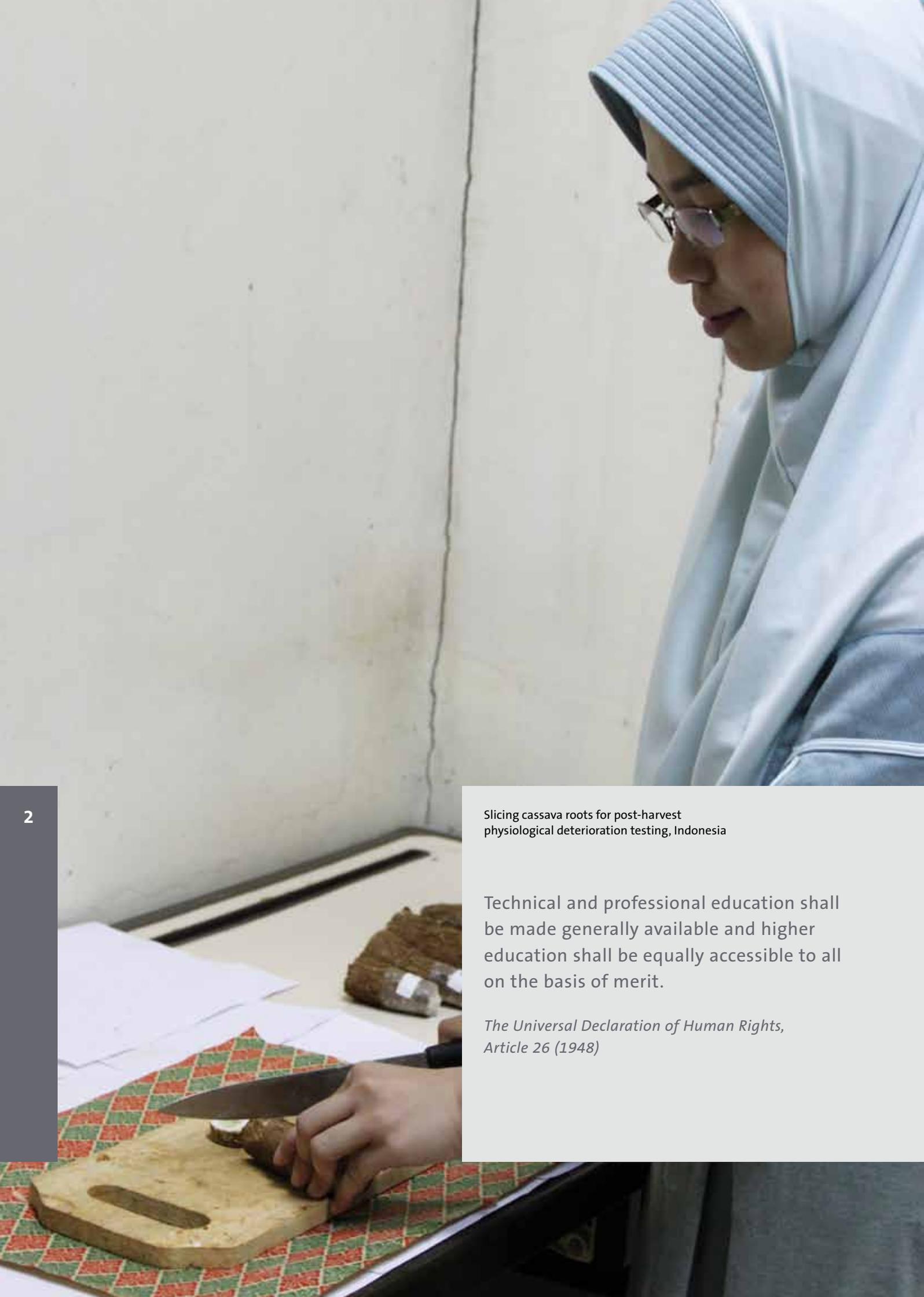
ETH Global inherits from the North-South Centre the network and some ongoing programmes. The governance structures of ETH Global will include the expertise of the members of the North-South Centre. Finally, Barbara Becker, the present Managing Director of the North-South Centre will become one of the three Directors of the new unit. With so much continuity I am sure that ETH Global can work efficiently without any delay.



Wolfgang Kinzelbach, President



Wolfgang Kinzelbach,
President of the North-South Centre



Slicing cassava roots for post-harvest
physiological deterioration testing, Indonesia

Technical and professional education shall
be made generally available and higher
education shall be equally accessible to all
on the basis of merit.

*The Universal Declaration of Human Rights,
Article 26 (1948)*

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A villager weaving *Pandanus* spp., a product gathered in the remaining forest fragments of Madagascar

Higher education does not figure on the poverty-reduction agenda of many developing countries and international aid agencies [...]. Yet, [...] basic education rarely provides employment skills that can ensure a reasonable [...] standard of living.

Jandhyala B.G. Tilak, National University of Educational Planning and Administration, India (2007)

Transition to new horizons

The research programmes, the projects of our members and a broad range of events represented, as usual, the backbone of the North-South Centre throughout 2011. On top of that, the Centre invested its resources in identifying the best possible future institutional structure for “research for development” within the ETH Zurich. With the transition to ETH Global, the name of the unit will change – but the main activities will continue.

From the North-South Centre to ETH Global

2011 was a year of transition for the North-South Centre. A number of changes in the internal and external environment of the ETH Zurich induced a re-positioning of the institutional integration of North-South matters in the ETH portfolio. In 2010, the external evaluation of the North-South Centre confirmed the high quality of its work and its essential contribution to the ETH profile. The development of the ETH Strategy 2013–16 revealed, however, that the cross-cutting mandate of the North-South Centre was not optimally captured by its structure as a competence centre. In the new ETH strategy the competence centres are predominantly focused around specific topics, while cross-cutting issues such as sustainability or North-South collaboration turned out to fit better with the central services of the ETH Zurich.

Many of the thematic competence centres reflect the strategic priorities of the ETH Zurich. In 2011, the ETH Zurich

established a new competence centre on the world food system which became operational by the end of the year. This new centre is a natural ally of the North-South Centre and in the course of 2011 both sides explored the optimal interface between the two entities.

After considering various alternatives, the teams of the North-South Centre and International Institutional Affairs (IIA) entered into a very constructive discussion. First, we jointly elaborated the global strategy of the ETH Zurich, and subsequently explored a structural merger into a new unit called ETH Global. The North-South Centre and IIA had been established approximately at the same time. During the past years, the two teams had already developed joint activities and a constructive collaboration.

In November 2011, the Steering Committee of the North-South Centre and the International Advisory Board of IIA – in a sequence of two parallel meetings and a joint session – agreed to pursue this merger. The proposal was brought to the General Assembly of the North-South Centre which confirmed this move in December. However, the members suggested a couple of measures which should allow maintaining their active engagement and commitment. Amongst others, they proposed to set-up a special committee on North-South matters as well as a network of interested ETH scientists. In January 2012, the School Board of the ETH Zurich accepted the proposal to establish ETH Global as an office under the ETH President. This decision will become effective as of August 1, 2012.

ETH Global will be led by Professor Gerhard Schmitt, the Senior Vice-President ETH Global, who until now was the Senior Vice-President for International Institutional Affairs. The merger permits the identification of new strategic priorities with added value for the ETH Zurich, and allows consistent communication on international affairs. Since the new unit will be part of the President’s office, the



Barbara Becker, Managing Director of the North-South Centre

activities related to developing countries will receive increased strategic relevance and visibility.

At the management level, both teams will be integrated into one office with a total of ten staff members (some employed part-time). The management team of ETH Global will be composed of the former two IIA Directors Margrit Leuthold (ML) and Anders Hagström (AH) complemented by Barbara Becker (BB) as the former Managing Director of the North-South Centre. Their respective responsibilities are global institutional affairs (ML), global educational affairs (AH) and global transformation affairs (BB). Unfortunately, not the entire management staff of the North-South Centre will be able to continue in the new structure. Ursula Gugger Suter and Patricia Heuberger will be part of the new ETH Global team. All other staff members have found satisfying new positions or perspectives.

Dorota Niedzwiecka will help establish the new World Food System Center, with which the North-South Centre management has established close ties in the meantime. Both centres are involved in a couple of joint projects. The North-South Centre will hand over part of its competencies in the form of knowledge and software to the World Food System Center. Furthermore, Barbara Becker will be a special guest in the Steering Committee of the competence centre.

Continuation of the North-South programme

The transition to the new structure absorbed a large portion of our management capacity. Nevertheless, the normal programme of the North-South Centre continued as usual.

Early in 2011, we could negotiate an extension of our two ongoing contracts with the Swiss Agency for Development



(From left to right): Wolfgang Kinzelbach, President of the Swiss Confederation Micheline Calmy-Rey, ETH President Ralph Eichler, SDC Director Martin Dahinden and Barbara Becker at the inaugural event of the SDC anniversary on September 30, 2011

and Cooperation (SDC) until the end of 2012. With the last candidates concluding their doctoral theses, the programme on livestock systems research came to an end in the course of 2011. The contract extension permitted the prolongation of two postdoctoral studies (see pages 54–55) and the continuation of some short-term projects and outreach activities. Due to the finalisation of the livestock systems research programme, Mathias Egloff terminated his position as programme coordinator in July 2011. At the same time he handed over his responsibility as secretary of the LivestockNet association to Peter Hofs of the School of Agricultural, Forest and Food Sciences HAFL in Zollikofen (formerly SHL).

Part of the SDC contract extension was a review of the livestock systems research programme from 2002 to 2011. This study was conducted by the agro-economist Martijn Sonneveld, who himself had been involved in one of the projects as a doctoral student in an earlier phase of his career. A summary of his report is given on pages 52–53.

The extension of the SDC-funded Research Fellow Partnership Programme (RFPP) permitted two more calls in 2011. The respective projects are presented on pages 56–69. The Sawiris Scholarships programme (see pages 70–73) is now in full swing with well-established procedures and criteria. In May 2011, we enjoyed the interaction with Samih Sawiris who visited the ETH Zurich on the occasion of the selection committee meeting.

A new initiative of the North-South Centre was a pilot project funded by the Lucerne-based Arthur Waser Foundation. A Sustainable Rural Dwelling Unit (SRDU) was built in a village in Ethiopia in collaboration with the Ethiopian Institute of Architecture, Building Construction and City Development (EiABC) of Addis Ababa University. This pilot project builds on the 2010 ETHiopia Urban Laboratory Summer School between ETH Zurich and the EiABC, which was

organised around constructing a Sustainable Urban Dwelling Unit (SUDU). The SRDU project is presented in more detail on pages 74–75. This pilot investment led to a longer-term partnership between the Arthur Waser Foundation and the ETH Zurich starting in 2012.

The ties with EiABC were further strengthened, when in May 2011 EiABC hosted a workshop of the Global Alliance of Technological Universities (GlobalTech). GlobalTech is a consortium of seven leading technical universities from Asia, the USA and Europe. The workshop served to present various ongoing projects and to explore options for future joint projects of GlobalTech members with partners in sub-Saharan Africa. ETH Zurich was the GlobalTech member responsible for organising the workshop, which was prepared jointly by IIA and the North-South Centre. The ETH President Ralph Eichler used the occasion of the workshop to familiarise himself with the EiABC and the Ethiopian environment. Concluding the workshop, the Swiss Ambassador in Ethiopia, Dominik Langenbacher, gave a reception at which the Ethiopian Minister for Civil Services (and Chair of EiABC's supervisory board) H.E. Junedyi Saddo met representatives of the GlobalTech universities.

The North-South Centre as competence centre is only partially involved in teaching. One example is our annual colloquium on selected aspects of sustainable development. It brings together young scientists with different backgrounds working on development-related topics. The aim of the colloquium is to provide doctoral students with the chance to discuss their projects with an interdisciplinary audience in order to hear new perspectives and get surprising and unexpected feedbacks on their research.

Dialogue and awareness

One of the three pillars of the North-South Centre is to communicate North-South collaboration within the ETH Zurich and to the wider public. In 2011, this task was one of

the predominant activities of the North-South Centre. SDC commissioned the centre to organise a series of events in Zurich on the occasion of its 50th anniversary. The main reason for hosting the SDC anniversary at the ETH Zurich goes back to the role of the ETH Zurich in the creation of SDC. Starting in 1950, a small unit of the ETH management served as advisor to the Swiss government on technical cooperation with developing countries. In 1955, parts of the operational functions of this fast growing service were transferred to the federal administration. With the creation of the “Service for Technical Cooperation” in 1961 the ETH service was finally replaced by the new agency, from which the SDC of today emerged.

The SDC anniversary provided a unique opportunity for several ETH units to jointly organise a series of events for different target groups. Apart from the North-South Centre as main coordinator, the following ETH groups were in-

involved in one way or another: Corporate Communication and four units of the Department of Humanities, Social and Political Sciences, namely the Archives of Contemporary History, the Chair of History of the Modern World, the Chair of History of Technology, and the Center of Development and Cooperation (NADEL).

The event series “*Denkplatz Entwicklung*” started on September 30 with a public anniversary celebration, at which the President of the Swiss Confederation Micheline Calmy-Rey was present, together with SDC Director Martin Dahinden and ETH President Ralph Eichler. The programme was a lively combination of examples of past and current North-South collaboration, cross-over music and a creative projection into the future by a group of students. The students had elaborated their visions in a preceding workshop with 23 participants from seven Swiss universities representing 13 nationalities. The inaugural event also served



Workshop on visions for international cooperation: The 23 participants representing 13 nationalities together with the resource persons, facilitators and organisers at the closing photo session, September 17, 2011

to launch the public exhibition “The other side of the world” (www.humem.ch) in the ETH main building, which was open throughout the entire period until November 11.

Other public events included two debates on the controversial impact of foreign aid in Africa and on economic and ethical motives for solidarity, respectively, and an interview with one of the pioneers of Swiss development cooperation. For school classes, guided tours through the exhibition and interviews with development pioneers were organised. A research colloquium on the history of Swiss development cooperation targeted scientists only. The series concluded with the annual conference of the North-South Centre on ICT4D – The development impact of information and communication technologies.

Overall, “*Denkplatz Entwicklung*” attracted several hundred of interested participants, provoked lively debates and

received broad media attention. Internally, it permitted very constructive interaction between the different ETH groups, with the colleagues from SDC and with the authors of the exhibition. The source material and the exhibition, which remains on tour in 2012, will finally be transferred to the Archives of Contemporary History of the ETH Zurich – partly as a result of the constructive collaboration during the anniversary.

Independent of the anniversary programme, the North-South Centre organised two North-South Fora jointly with the NCCR North-South and the Commission for Research Partnerships with Developing Countries (KFPE). The one in April at the ETH Zurich discussed “Phosphorus – A bottleneck of nature” and the other one in November in Basel “Water diplomacy”. In June, the North-South Centre jointly with the State Secretariat for Economic Affairs (seco) co-hosted the international conference of ISEAL – the global



(From left to right): Rolf Kappel (NADEL), Barbara Bleisch (Centre for Ethics at the University of Zurich), Res Strehle (Tages-Anzeiger), Martin Dahinden (SDC) and Gerold Bühler (economiesuisse and Swisscontact) discussing economic and ethical motives for solidarity, November 2, 2011

association for social and environmental standards – on “Scaling up the impacts of standards systems”. In September, the North-South Centre was responsible for a session on smart energy strategies for development at the annual conference of the Energy Science Center, ETH Zurich.

In November and December, the North-South Centre organised two public lectures at the ETH Zurich. Shenggen Fan, the Director General of the International Food Policy Research Institute (IFPRI) in Washington DC covered the topic “Feeding the world by 2050”. “Reform zones that drive development” were discussed by the internationally renowned economist Paul Romer, founder and president of Charter Cities. The North-South Centre together with NADEL and *cinfo* organised a workshop in December which targeted advanced students and doctoral candidates. Representatives of the World Bank and the Inter-American Development Bank presented job opportunities in the two institutions.

Several members of the North-South Centre were invited to give talks on their research, examples of which are given in the publication list under oral presentations. The Managing Director of the North-South Centre gave a lecture at the annual conference of the Alliance for Global Sustainability at the University of Gothenburg, Sweden. In addition, she was on TV on two occasions: In January in the news broadcast of Swiss Television commenting on record-breaking high food prices and in February in an extensive scientific debate on food security on a private channel in Austria. Furthermore, the Managing Director was invited as key speaker on food security, opening the semester programme (*Startwoche*) at the University of St. Gallen with more than one thousand new students. She also served on the jury who selected the best presentations that had been elaborated in group work during the week.

Two issues of the public newsletter *Perspectives* were distributed electronically to some 1500 readers: the March

issue addressed the topic of forestry research and the September issue highlighted ICT4D.

Internally, the North-South Centre has continued to serve its members regularly with a news mail. Furthermore, monthly lunch meetings for doctoral students took place every first Wednesday of the month, allowing exchanging ideas with peers. These lunch meetings, initiated in 2009 for young scientists interested in development issues, are always very well visited and highly appreciated.

Swiss and international networks and strategic debates

The North-South Centre is actively involved in networking on both the operational and the strategic levels, nationally and internationally. Through its networking activities, it participates in strategic debates on research for development in Switzerland and abroad.

Many members of the North-South Centre are represented in various strategic bodies of the ETH Zurich, as well as in national and international scientific associations, advisory boards or the like. Within the ETH Zurich, the prime partner of the North-South Centre over the last year had been IIA, with whom it will merge as explained previously. Our friendly neighborhood relations with NADEL were cultivated with informal monthly meetings. Another important partner was the ETH Foundation, who has supported us in various ways in our efforts to attract third-party funding.

Nationally, the North-South Centre relates as peer to the NCCR North-South and to our sister unit Cooperation & Development Center at the EPFL. We are an active member of the KFPE and the Swiss Forum for International Agricultural Research (SFIAR). In the private sector, we maintained relations with Swiss Re and Syngenta among others. The Managing Director continued her collaboration with the Oeuvre St Justin and their Justinus-Haus in Zurich which provides affordable housing for international students.

The association again granted a couple of scholarships to participants from developing countries earning the Master of Advanced Studies in Sustainable Water Resources offered by the Institute of Environmental Engineering (D-BAUG).

Internationally, the collaboration with IIA linked the North-South Centre to the activities of the GlobalTech Alliance and strengthened our ties with EiABC. Both links are associated with the Future Cities Laboratory in Singapore, where the ETH Zurich has established an outpost in 2010. The Managing Director had the opportunity to visit this site on her way back from the Oversight Committee meeting of the Global Rice Science Partnership in Manila, where she represented the Africa Rice Center. The trip to the Philippines and Singapore provided valuable insights into different university cultures and was one of the inspirations for the “Focus” chapter of this Annual Report. Equally inspiring was a workshop in June on tertiary agricultural education in Africa,

preceding the annual Agri-Natura meeting, in which the Managing Director took part.

Andreas Sicks represented the North-South Centre in a workshop on engineering sciences and education in sub-Saharan Africa by the German Volkswagen Foundation, which launched a programme to support engineering disciplines on this continent. Such a promising initiative may serve as a model for other programmes in the fields of technology and infrastructure.

*Barbara Becker,
Managing Director of the North-South Centre*



Two visitors learning about the pioneers of Swiss development cooperation and humanitarian aid as portrayed in the exhibition “The other side of the world”, September 30, 2011



Donor-driven green bean grading for high-value supply chains, Tanzania

In Namibia, Zimbabwe and Tanzania, there is one qualified engineer for a population of 6000 people, compared to one engineer per 200 people in China.

Irina Bokova, Director-General, UNESCO (2012)

Rationale and strategy

The North-South Centre is the focal point of the ETH Zurich in all affairs that involve developing countries and emerging economies. It promotes research collaboration and capacity development in international development and cooperation covering the technical, natural, human and social sciences. The North-South Centre builds on the comparative advantage of the ETH Zurich as one of the leading technical universities worldwide. It uses the competences of its members and their disciplinary strengths. Thus, the research activities of all members represent the core of the North-South Centre. Resulting partnerships with research institutions, governmental organisations, development agencies and other stakeholders in the North and in the South are an important pillar of the Centre.

The activities of the North-South Centre cover three main areas: (i) research collaboration, (ii) capacity development and (iii) networking and communication. Thereby, the North-South Centre promotes the ETH Zurich as a leading institution on North-South matters in its field – research and education.

The Strategy 2010–2016 positions the North-South Centre within the ETH Zurich by relating it to the overall ETH strategy, its international strategy and the strategies of individual departments. The strategy of the North-South Centre lays out the conceptual approach of research for development. It defines sustainable development for human well-being as overall goal and identifies four thematic research areas: (i) food security, (ii) natural resource management, (iii) urban and rural transformation, and (iv) technology and infrastructure. In addition, it draws attention to three transversal topics, which cut across the four research areas: gender, good governance and impact generation.

With regard to capacity development, the strategy highlights the importance of individual capacity development as primary task of the North-South Centre. We serve our

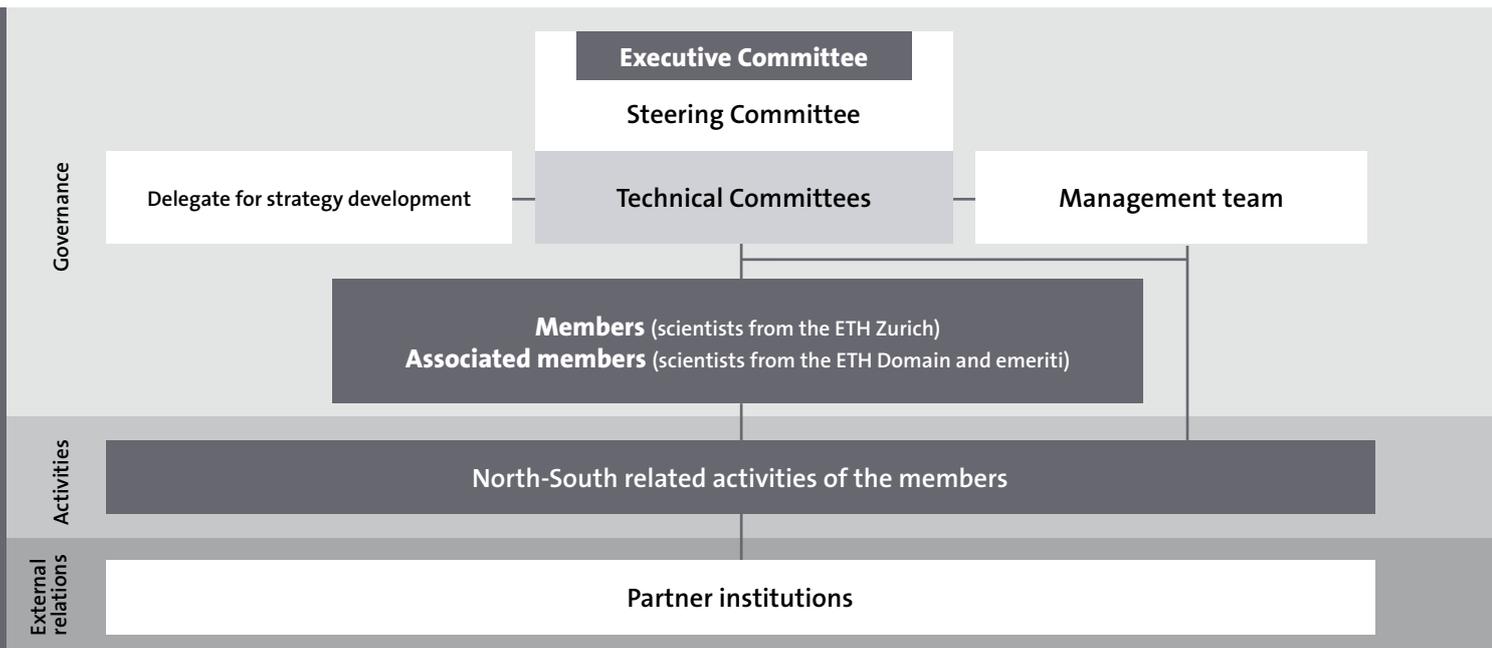
target groups through a variety of instruments such as grants or scholarships, support to visiting scientists or for teaching stays, through summer schools and a colloquium for doctoral candidates.

In the area of networking and communication, strengthening the networks with our strategic partner institutions in Switzerland and in developing countries is one of the key tasks. The North-South Centre maintains a range of communication tools to address its internal and external stakeholders.

Membership and organisational structure

Department	Professors	Senior scientists and post-docs	Doctoral students	Total
Department of Agricultural and Food Sciences (D-AGRL)	10 (-1)	10 (+2)	5 (-1)	25 (0)
Department of Architecture (D-ARCH)	3 (0)	1 (0)	2 (-1)	6 (-1)
Department of Biology (D-BIOL)	1 (0)	2 (0)	1 (0)	4 (0)
Department of Civil, Environmental and Geomatic Engineering (D-BAUG)	5 (0)	3 (0)	2 (-1)	10 (-1)
Department of Computer Science (D-INFK)	1 (0)	1 (0)	0 (0)	2 (0)
Department of Earth Sciences (D-ERDW)	4 (0)	3 (0)	0 (0)	7 (0)
Department of Environmental Sciences (D-UWIS)	14 (+1)	12 (+4)	3 (-5)	29 (0)
Department of Humanities, Social and Political Sciences (D-GESS)	5 (+1)	0 (-1)	4 (+2)	9 (+2)
Department of Information Technology and Electrical Engineering (D-ITET)	1 (0)	1 (0)	0 (0)	2 (0)
Department of Management, Technology and Economics (D-MTEC)	2 (0)	1 (0)	1 (0)	4 (0)
Associated members	11 (+1)	5 (0)	1 (+1)	17 (+2)
Total	57 (+2)	39 (+5)	19 (-6)	115 (+2)

Membership as of December 31, 2011; the numbers in brackets show the difference as compared to December 31, 2010



Organisational structure of the North-South Centre

Committees and management team

Executive Committee

Wolfgang Kinzelbach, D-BAUG (President)
Stefanie Engel, D-UWIS (Vice-President)
Michael Kreuzer, D-AGRL (Vice-President)

Steering Committee

Wolfgang Kinzelbach, D-BAUG (President)
Stefanie Engel, D-UWIS (Vice-President)
Michael Kreuzer, D-AGRL (Vice-President)
Marc Angéilil, D-ARCH (as of August 2011)
Jean-Pierre Burg, D-ERDW
Silvia Dorn, D-AGRL (until July 2011)
Ines Egli, D-AGRL
Jaboury Ghazoul, D-UWIS
Isabel Günther, D-GESS (as of July 2011)
Rolf Kappel, D-GESS
Renate Schubert, D-GESS (until June 2011)
Rainer Schulin, D-UWIS
Achim Walter, D-AGRL (as of August 2011)
Barbara Becker, Managing Director (*ex officio*)

Delegate for strategy development

Olaf Kübler, former President of the ETH Zurich

Technical Committee for Natural Resource Management

Stefanie Engel, D-UWIS (Chair)
Nina Buchmann, D-AGRL
Jaboury Ghazoul, D-UWIS (until June 2011)
Stefanie Hellweg, D-BAUG
Dani Or, D-UWIS

Technical Committee for Food Security

Michael Kreuzer, D-AGRL (Chair)
Silvia Dorn, D-AGRL (until July 2011)
Ines Egli, D-AGRL
Emmanuel Frossard, D-AGRL
Bernard Lehmann, D-AGRL (until June 2011)
Achim Walter, D-AGRL (as of August 2011)

Technical Committee for Urban and Rural Transformation

Marc Angéilil, D-ARCH (Chair)
Isabel Günther, D-GESS
Margrit Hugentobler, D-ARCH
Renate Schubert, D-GESS (until June 2011)
Chris Zurbrügg, Eawag

Technical Committee for Technology and Infrastructure

Wolfgang Kinzelbach, D-BAUG (Chair)
Hans Jürgen Herrmann, D-BAUG
Hans Hinterberger, D-INFK
Thomas F. Rutherford, D-MTEC
Gerhard Tröster, D-ITET

Technical Committee for Capacity Development

Rainer Schulin, D-UWIS (Chair)
Jean-Pierre Burg, D-ERDW
Jaboury Ghazoul, D-UWIS (as of July 2011)
Rolf Kappel, D-GESS
Michael Siegrist, D-AGRL (until June 2011)
Jean-Pierre Sorg, D-UWIS

Management team

Barbara Becker, Managing Director
Mathias Egloff, Programme Officer (until July 2011)
Ursula Gugger Suter, Communication Manager
Patricia Heuberger-Meyer, Programme Officer
Emma Lindberg, Programme Officer
Monika Lusser, Interim Communication Manager (until August 2011)
Roger Merz, Programme Assistant
Dorota Niedzwiecka, Programme Assistant
Andreas Sicks, Programme Officer



The North-South Centre management team in 2011 (clockwise from upper left): Mathias Egloff, Monika Lusser, Barbara Becker, Ursula Gugger Suter, Andreas Sicks, Roger Merz, Emma Lindberg, Dorota Niedzwiecka, Patricia Heuberger-Meyer

Financial statements

Administratively, the North-South Centre is a unit of the ETH Zurich funded partially by ETH credits and by third-party contracts, primarily from the public sector. All funds are allocated to predefined activities according to the objectives of the Centre and its specific contracts.

All accounts were audited and unconditionally approved.

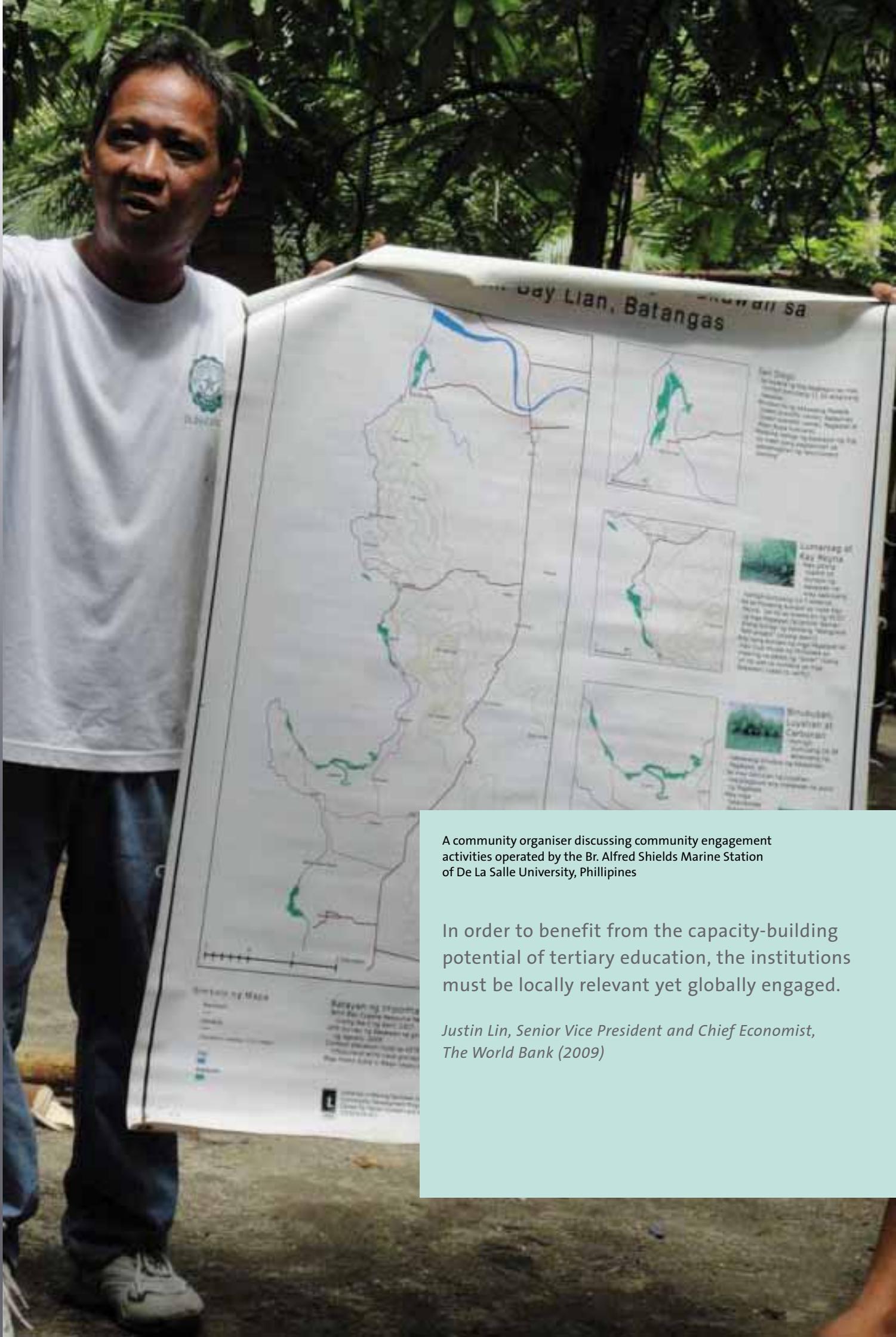
Balance sheet

Assets	CHF
Management	
Cash	300
Operating funds (ETH accounts)	342 270
Receivables, third parties	72 977
Subtotal assets, management	415 547
Programmes	
Operating funds (ETH accounts)	1 235 281
Receivables, third parties	18 427
Subtotal assets, programmes	1 253 708
Total assets	1 669 255
Liabilities	
Management	
Equity	571 560
Liabilities, third parties	8 418
Over-expenditure	-164 431
Subtotal liabilities, management	415 547
Programmes	
Equity	1 336 131
Over-expenditure	-82 423
Subtotal liabilities, programmes	1 253 708
Total liabilities	1 669 255

Income statement

Expenditure	CHF
Management	
Personnel *	459 144
Operations	46 991
Public relations	119 632
Subtotal expenditure, management	625 767
Programmes	
Seed money and grants (ETH contribution)	51 657
Livestock systems programme (SDC contribution)	435 516
RFPP fellowships (SDC contribution)	633 018
Sawiris scholarships	191 422
Bioenergy	4 050
Waser	90 000
Subtotal expenditure, programmes	1 405 663
Total expenditure	2 031 430
Income	
CHF	
Management	
Member contributions	39 200
Contribution S-ENETH 2011	50 000
SDC management contributions (livestock systems programme & RFPP)	261 254
Other income, third parties	110 882
Subtotal income, management	461 336
Programmes	
ETH contribution (seed money and grants)	54 258
SDC contribution (livestock systems programme, research projects)	300 000
SDC contribution (RFPP fellowships)	800 000
Sawiris scholarships	327 651
Bioenergy	4 050
Waser	120 244
Subtotal income, programmes	1 606 203
Transfer management and conferences	282 962
Total income	1 784 577
Over-expenditure	-246 853

* Personnel expenses for the Managing Director are covered by the ETH Zurich directly (through D-UWIS).



A community organiser discussing community engagement activities operated by the Br. Alfred Shields Marine Station of De La Salle University, Philippines

In order to benefit from the capacity-building potential of tertiary education, the institutions must be locally relevant yet globally engaged.

Justin Lin, Senior Vice President and Chief Economist, The World Bank (2009)

Striving for academic excellence

Higher education plays a crucial role in development. Through research and teaching, universities contribute to produce expertise, induce social transformation and preserve social and cultural values. Striving for academic excellence therefore does not result from the hype surrounding world-class institutions and rankings, but is derived from basic needs in respective national environments.

This “Focus” chapter was inspired by encounters with colleagues from universities in the South which led to fascinating discussions on the underlying values and principles to become or remain a top university in the cultural and economic environment of the respective country. We are glad that several colleagues accepted our invitation to share their experiences in our Annual Report in spite of their heavily loaded agendas.

Ihron Rensburg from the University of Johannesburg (South Africa) spent a couple of days at the ETH Zurich to meet with members of the School Board and staff involved in international relations. In his chapter, he shares the responses to his well-targeted questions how to achieve and maintain academic excellence in his institution.

Arnulfo Azcarraga from the De La Salle University (DLSU) in Manila (Philippines) is a long-standing partner of the ETH Zurich and the North-South Centre. Between 2005 and 2008 Jürg Nievergelt, a retired ETH professor in computer sciences, conducted three subsequent IT courses at DLSU and two other Philippine universities, which were supported by the North-South Centre. In return, Arnulfo Azcarraga together with Brother Armin Luistro FSC, who was President and Chancellor of DLSU at that time, visited the ETH Zurich a couple of times to explore further options for collaboration. In his chapter, Arnulfo Azcarraga reflects on how the values of the catholic founders translate into the management of DLSU for the benefit of the modern Philippine society.

In an earlier encounter, *Ana María Cetto* from UNAM (Mexico) shared her enthusiasm in voluntarily coordinating a network of editors of scientific journals in Latin America. This commitment is one of her contributions to improve the scientific standards of her academic environment. In her chapter, she reflects on decades of experience in developing the sector of tertiary education and research in Latin America. She considers “excellent” institutions as only

the tip of an iceberg which would not exist without the much larger hidden part of the system.

These “views from the South” are complemented by an interview with the ETH President *Ralph Eichler* on his perception of academic excellence and the role of the ETH Zurich vis-à-vis its partner institutions in developing countries.

This chapter is introduced by the summary of a World Bank publication on the making of world-class universities by Jamil Salmi and Philip G. Altbach. They draw on decades of experience in improving the tertiary education sector world-wide and conclude that the alignment of concentrated talent, abundant resources and favourable governance are the principle factors for making world-class universities. In this sense, the ETH Zurich has ample experience to share.



Patrick Murigu Kamau Njage, Christoph Jans and Dasel Wambua Mulwa Kaindi working on bacteria isolated from camel milk products at Analabs, Nairobi, Kenya

The making of world-class research universities

“The Road to Academic Excellence: The Making of World-Class Research Universities” by Philip G. Altbach and Jamil Salmi (editors) examines the recent experience of eleven universities in nine countries on four continents that have grappled with the challenges of building successful research institutions under difficult circumstances. This article explains the conceptual approach and summarises the lessons learned.

The positive contribution of tertiary education to economic development is increasingly recognised. It is not limited to middle-income countries and industrial nations, but applies equally to low-income economies. Tertiary education can help these countries to become more competitive globally by developing a skilled, productive, and flexible labour force and by creating, applying, and spreading new ideas and technologies. In addition, universities play a key role in society by serving as cultural institutions, centres for social commentary and criticism, and intellectual hubs. The availability of qualified professionals and technicians and the application of advanced knowledge help developing countries achieve the Millennium Development Goals and build the institutional capacity essential to reduce poverty. Progress in agriculture, health, and environmental protection, for example, cannot be achieved without highly qualified specialists in these areas. Similarly, education for all cannot be reached without qualified teachers trained at the tertiary education level.

How do you build a world-class research university from scratch?

In today’s ever-faster global economy, many countries are reflecting on the merits of building elite universities, recognising that such globally attractive universities are emerging as the central institutions of the 21st century’s knowledge economies. A major challenge for building and sustaining successful research universities in middle-income and developing countries is determining the mechanisms that allow these universities to participate effectively in the global knowledge network on an equal basis with top academic institutions in the world.

Until recently, being deemed “world-class” was based on a subjective qualification, mostly but not exclusively, of perceived reputation. However, no rigorous measures existed to quantify the inputs and processes that led to the superior achievements and status of world-class universities. The

proliferation of international league tables in the past few years has created more systematic ways of identifying and classifying world-class universities. Reactions to these rankings have ranged from plans to create alternative rankings to proactive policies in support of qualitative transformations in the university sector. Or, to behavioural changes at the institutional level where universities have become more selective to fare better in rankings that measure the academic scores of incoming students. However, building a world-class institution requires much more than spontaneous reactions to the rankings or massive infusions of government money – it is a complex and lengthy process.

Characteristics of a world-class university

The superior results of top research universities – highly sought graduates, leading-edge research, and dynamic knowledge and technology transfer – can be attributed to three complementary sets of factors: (a) a high concentration of talent among faculty members and students; (b) abundant resources to offer a rich learning environment and to conduct advanced research; and (c) favourable governance features that encourage leadership, strategic vision, innovation, and flexibility and that enable institutions to make decisions and manage resources without being encumbered by bureaucracy. It is the dynamic interaction among these three groups of features that makes the difference as the distinguishing characteristic of high-ranking research universities.

Pathways of development

Building a world-class university requires alignment of these three sets of factors that, together, determine the performance of research universities. In addition, a number of “accelerating factors” can play a positive role in the quest for excellence: (i) Convincing large numbers of overseas scholars to come back to their country of origin, (ii) using English as the main language, (iii) concentrating on niche

areas, (iv) introducing significant curriculum and pedagogical innovations, and (v) remaining vigilant and maintaining a sense of urgency to avoid complacency.

The importance of the tertiary education ecosystem

The analysis cannot be complete without a systematic look at the role of the tertiary education ecosystem, which represents the relevant external forces that directly influence – positively or negatively – the ability of research universities to prosper.

Amongst others, the performance of tertiary education institutions is influenced by:

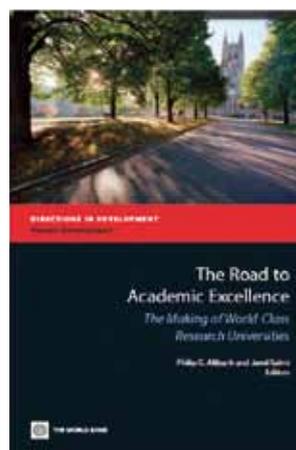
- The overall political and economic situation of a country, the rule of law and the enforcement of basic freedoms
- The existence of a vision and a strategic plan to shape the future of tertiary education
- The governance structure and processes at the national and institutional levels that determine the degree of autonomy
- The absolute volume of resources available and the respective allocation mechanisms
- The links and bridges between high schools and tertiary education and the pathways and procedures integrating the various types of tertiary education institutions

The absence of some of the elements or the lack of alignment among the various dimensions is likely to compromise the ability of research universities to thrive and endure.

Conclusion

For their study, Philip G. Altbach and Jamil Salmi analysed eleven institutions¹ whose trajectories offer valuable insights into the complex transformation process that institutions are undergoing when striving to become world-class research universities. With proper leadership and vision, existing research universities can drastically improve the quality of their teaching and research. Alternatively, when talent, resources, and governance are adequately aligned from the beginning, new universities have the potential to grow into high-quality research institutions within two or three decades. However, success is fragile and prestigious universities, like famous empires, are prone to fateful destinies should the fundamental enabling conditions disappear.

All of the case studies confirm the importance of maintaining the three sets of key factors put forward in the



Altbach, P.G., Salmi, J., (eds.), 2011: *The Road to Academic Excellence: The Making of World-Class Research Universities*. The World Bank, Washington DC, USA: 363 pp.

Philip G. Altbach is the J. Donald Monan, S. J. University Professor and the director of the Center for International Higher Education in the Lynch School of Education at Boston College. He has been a visiting scholar at the Sciences Po in Paris, France, and the University of Mumbai in India; and is a guest professor at Peking University in China. His most recent book is: *World Class Worldwide: Transforming Research Universities in Asia and Latin America*, Baltimore: Johns Hopkins University Press, 2007.

Jamil Salmi, a Moroccan education economist, is the World Bank's tertiary education coordinator. He is the principal author of the Bank's tertiary education strategy titled "Constructing Knowledge Societies: New Challenges for Tertiary Education." For the past 17 years, he has provided policy advice on tertiary education reform to the governments of more than 60 countries in Europe, Asia, Africa, and South America. His latest book is: *The Challenge of Establishing World Class Universities*, Washington, DC: World Bank, 2009.

conceptual framework – concentrated talent, abundant resources, and favourable governance – well aligned. A significant new finding is the weight of the tertiary education ecosystem in influencing the performance of research universities seeking to achieve world-class status.

*Summarised by Ursula Gugger Suter,
Communication Manager, North-South Centre, ETH Zurich*

¹ Higher School of Economics (Russian Federation), Hong Kong University of Science and Technology (China), Indian Institutes of Technology (India), Monterrey Institute of Technology (Mexico), National University of Singapore, Pohang University of Science and Technology (Republic of Korea), Pontifical Catholic University of Chile, Shanghai Jiao Tong University (China), University of Chile, University of Ibadan (Nigeria), University of Malaya (Malaysia)

Nurturing and sustaining excellence against the odds: A view from the periphery

Recently, I spent a short sabbatical visiting a number of leading universities. I was concerned about how I should steward the University of Johannesburg (UJ) beyond its initial post-merger phase to sustained excellence. In 2005, the new institution brought together three universities that had existed between 22 and 102 years. As its first Vice Chancellor, I had relied significantly on an inclusive – as opposed to an administrative or authoritarian – managerial approach suited for such a challenging time. The complicated merger that none of the merging parties wanted, and that brought together technological and traditional university education, has now been rated as one of the most successful mergers of recent times.

Inclusive managerialism, with its preoccupation with the detailed development and implementation of institutional vision, mission, goals, strategy, plans and performance indicators has been a great resource in our founding years. Yet, I was convinced that it would not be of much assistance in the period ahead. I felt I needed to look more closely at institutions with flourishing collegial cultures focusing on academic disciplines, research, scholarship and dissemination of knowledge.¹ In short, at institutions that are today principally renowned for sustained excellence. Too often, we associate excellence only with accredited research output and impact and with the ability to attract the most talented staff and students. The challenge, rather, is to develop a more inclusive definition of excellence – One that values widened student access and participation, outstanding undergraduate education and exceptional teaching no less than the above-mentioned dimensions. Part of this challenge is to move beyond those perennial sources of unhappiness and anomie: The polarities of top-down vs bottom-up, management vs scholarship, controlled vs devolved, focus vs variety, and competition vs collaboration.² By changing the “vs” to “plus/and” we can draw on the full complement of cultures and experiences and wisely steward our institutions.

On my journey, I conducted focused visits to four public universities that have come to be ranked among the top 50 research universities in the last twenty years: The University of British Columbia (UBC), the University of Warwick (WU), the University of Hong Kong (HKU), and the National University of Singapore (NUS). As my control, I also visited the ETH Zurich, an institution with a much longer track record of sustained research excellence. I spent time, albeit briefly, at the University of Zurich, the Hong Kong University of Sci-

ence and Technology (HKUST), and the University of Technology Malaysia. At all these institutions I was privileged to meet with fellow vice chancellors/presidents along with senior executives, deans and scholars. I will share here some of what I have learned.

Message 1: Nurture a successful higher education and science and technology innovation system is critical to national social, economic and cultural ambitions. This requires considerable vision, purposefulness and investment.

This is quite evident in the case of UBC, NUS, HKU, ETH and HKUST. By creating nodes of excellence and staffing them with top scholars, these institutions attracted other leading academics and high quality students, which in turn enhanced their reputations, contributed to their global rankings and enabled them to mobilise significant donations, gifts and government funding. Since alumni, donors and governments tend to associate with excellence and leadership, a virtuous cycle was created. Add to this cycle the immeasurable advantages of spatial location and one has a formula for sustained excellence. South Africa's universities provide ideal locations for a range of academic pursuits, such as UJ's proximity to paleo-anthropological and geomorphological sites, and its appeal to those wishing to study political, economic, historical and cultural transitions in action.

This message is particularly important for developing nations where such vision and purposefulness, let alone the right level of resources, is rarely found, leaving universities dependent on their own devices to pull themselves up and to sustain excellence. For most universities in developing countries even the basics may not be in place. Given that institutional resources are always limited, universities could consider top-slicing all institutional budgets by 1% to support strategic projects that are critical to nurturing excellence. Simultaneously, they could seek to carefully select appropriate teaching and research niches in order to build critical mass and create momentum. Resource constraints inevitably bring to the fore the vexing question of institutional differentiation, and the importance (in developing nations) of efficiently allocating resources and focusing institutional effort. However, as long as all institutions aspire to be ranked within the top 100 universities, there will be very little room for institutional differentiation.

Message 2: Recruit top talent only.

At most of the institutions I visited, vice chancellors/presi-

dents are central to recruiting and appointing full professors, and are also active in talent identification and head-hunting. With regard to student recruitment, however, there is much greater variance. NUS, WU and UBC are only selecting the best, whereas at ETH and HKU open access is legislated.

Message 3: Select the right international academic partnerships and networks in order to offer immense value to reputation and global ranking.

HKU and NUS, for instance, devote considerable time and effort to selecting and investing in what they consider to be the right international networks and partnerships for their academics. By plugging into the top research and scholarly networks, they aim at increasing the reputations of both the scholars and their institutions.

Message 4: Search for the right balance between vision, strategy, performance and the collegial tradition.

Vice chancellors/presidents should focus on broad institutional strategy and stewardship and enable faculties and departments to develop detailed operational plans. This approach requires decision-making deans who are able to differentiate between departments rather than spreading limited resources evenly. HKU implements external, peer-led five-yearly faculty reviews of matters such as faculty stature, teaching and research excellence, impact and achievements. Similarly, HKUST conducts cyclical external peer reviews of institutional research niches and centres. Flatter and more inclusive institutional governance structures involving not only senior executives but also deans, a few senior scholars and student leaders help to nurture participation and buy-in.

Message 5: Nurture a collegial culture yet draw wisely upon management approaches.

The case of NUS is instructive: Twenty years ago it moved itself from an originally officious, administrative public service culture to a US style tenure culture with market-related, performance-based salaries and bonuses. A second shift, ten years ago, took it beyond mere quantitative measurements of research output to reviewing academics' profiles against high impact journals.

Message 6: Understand researching and teaching as non-divisible and integral to each other.

Currently, excellence is far too narrowly associated with the publication of research in leading journals. Consequently,



Ihron Rensburg

researchers are not only favoured in promotions policies, but spend little time in front of first year classes, thus devaluing teaching and learning. Parallel promotion pathways, as at UBC, NUS and (in experimental form) UJ, offer a new way forward by rewarding excellent teachers with full professor status. Ultimately, the consummate academic should be a discipline-based scholar of teaching and learning.

Undergraduate education lies at the core of the university mission, whether that mission is to accumulate knowledge or to produce good citizens, to provide marketable skills or intellectual inspiration.^{3,4}

*Ihron Rensburg, Vice Chancellor,
University of Johannesburg, South Africa*

¹ Bergquist, W., and Pawlak, K., 2008: *Engaging the Six Cultures of the Academy*. Jossey-Bass, San Francisco, CA, USA.

² *ibid.*: 234.

³ Keller, G., 2004: *Transforming a College*. Johns Hopkins University Press, Baltimore, MD, USA.

⁴ Lewis, H., 2006: *Excellence Without a Soul: How a Great University Forgot Education*. Public Affairs, Cambridge, MA, USA.

The University of Johannesburg (UJ) is born from the merger between the former Rand Afrikaans University, the Technikon Witwatersrand and the Soweto and East Rand campuses of Vista University in 2005. This academic architecture reflects a comprehensive range of learning programmes. The UJ addresses the needs of South African society and the African continent as it is committed to contribute to sustainable growth and development.

Excellence by whose standards? Excellence for whom?

The country: A thriving nation in the Pacific, just east of mainland Asia, the Philippines is home to over 100 million Filipinos, predominantly Catholic, of Malay stock, with deep Chinese, Spanish, and American influences. A country that is politically colourful, with a strong civil society. Large agriculture base, top exporter of mangoes, banana, pineapple, and coconut oil. Major exporter of semi-conductor and electronic products, transport parts, garments and copper. More than 10 million Filipinos working and living abroad, remitting around US \$20 billion to the local economy every year. A large segment of Philippine society living in poverty.

The university: De La Salle University, long considered the top private university in the country. De La Salle University started out as a small, liberal arts, American college way back in 1911. What was once an all-boys De La Salle College has blossomed into a large private, Catholic, comprehensive, Filipino university. The university finds itself at a juncture in its history where it has 100 years of hindsight that would allow it to project 100 years hence. Where is its rightful place in society in the next 100 years?

Every university aspires to be excellent in all that it does. And for that matter, De La Salle University has the drive, and indeed the resources to become an excellent university. But the drive to become excellent is not a matter of choice, nor about having the resources to be excellent. De La Salle University must be excellent. Society demands that it be excellent. Intimately linked with the economic progress as well as the socio-cultural and political awakening and maturity of Philippine society, De La Salle University has grown its roots in the country and must rise to the call and challenge to be an excellent institution.

But, excellence by whose standards?

Excellence for whom?

As the academic community mulled over the next 100 years and discerned what the new vision-mission should be, the usual phrases have been floated: “to become world-class”, “to be a leading research university”, “to be ready for a borderless, globalised world”. There were likewise the calls to be “a resource for God and country”, and to be an “instrument for inclusive growth in contemporary society”.

Following a period of laborious soul-searching and reflection, the university community spoke and converged on the following vision-mission:

A leading learner-centred research university, bridging faith and scholarship in the service of society, especially the poor.

The university indeed recognises the essence of its institution as a university, that it has to be engaged in research and must be an active player in the creation of new knowledge. It has to recruit professors with a track record in research and the entire learning infrastructure and the university physical space must reflect the bias towards research.

At the same time, the university must be learner-centred: Focused on each and every student that passes through its halls. Whether in academics, research, or community engagement, at the centre of everything it does are the students entrusted to its care.

The university, however, exists to be of service to society, especially the poor. Its reason for being is to be of service to society. Knowledge that percolates on campus need not always be new, for as long as it is used for the benefit of society. New or old knowledge, it does not matter much – what knowledge does for society is all that matters.

Finally, as a resolute Catholic university, open to the world yet firm in faith, the university finds and proclaims for everyone to hear that in everything it does, it seeks to discern God’s will and that it does everything “for the love of Him”.

Excellence as a “research university”

Dating back to the seventeenth century in Rheims and Paris, France, the Lasallian tradition has always focused on the formation of its students, has always been values-oriented in bridging faith and scholarship, and has always existed for the benefit of society. These core elements are present in each of the hundreds of La Salle schools scattered in 86 countries in the world, having a total enrolment of close to 1 million students.

It is really the matter of aspiring to become a “research university” that called for a significant amount of soul-searching. And so the same questions, but made more specific: Excellence as a “research university” by whose standards? Excellence for whom?

First and foremost, the vision of becoming a “research university” stems from a need to maintain an intellectual academic culture that is permanently open to the world of science, of technology, the social sciences, the arts, and

the humanities. De La Salle University must be part of the knowledge creation process. It must be active in pushing the frontiers of knowledge. It needs to be abreast with the latest discoveries, the latest trends in the disciplines, and the latest technological platforms that are in use outside its campus. De La Salle University needs to be in the position to understand the future before it becomes reality, just as it needs to be able to reconcile the past and explain its consequences on the present. Only research will allow the university to do all that.

The University, however, cannot aspire to become just a “research university”, the way the notion of “research university” is generally understood in the world. The qualifiers “learner-centred”, “bridges faith and scholarship”, and “in the service of society” are critical in defining De La Salle University’s own notion of a “research university”: An excellent research university by its own standards. Otherwise, De La Salle University as just a “research university” would not seem quite itself.

If research reigns supreme, so much more than teaching – that is not De La Salle University. If pure knowledge creation is the one sole metric of research success, so much more than the use of knowledge and technology to solve real problems – that, too, is not De La Salle University. If students are seen as mere foot soldiers, mere instruments in the supply-chain of knowledge-creation – that is not De La Salle University. If its search for knowledge eclipses its search for truth and meaning, if its passion for research is devoid of ethics, if its quest for excellence derails it from a path to wisdom, generosity, and solidarity – that is not De La Salle University.

Some research universities can possibly afford to be oblivious of societal needs. They sometimes choose to deliberately rise above the current problems and soar high above reality, so the knowledge that they produce can be pure, clean, and mathematically elegant. That is mostly a choice that researchers from world-class research universities can afford to make. Not for De La Salle University. Not in the Philippines!

What if a university in the Philippines never discovered new planets, new organisms, new materials, new sub-atomic particles – yet is able to distil a super-critical lemon grass extract and to use it to cure cancer? Or, if this university is able to design ferro-cement structures that withstand



Arnulfo Azcarraga

typhoons, earthquakes and floods and that are impervious to termites and to corrosion due to rain and seawater? What if it is not able to observe nano-particles for lack of sophisticated equipment but is able to design computer software that would computationally analyse new materials at the sub-atomic level and visualise them using ordinary laptops? What if it is not able to design a new computer architecture, but is able to re-use old and cheap CPUs (central processing units) and build contraptions that allow overseas Filipino workers to communicate with their families back home for free? What if it does not have the technology to use sophisticated membranes and reverse osmosis to desalinate water, but is able to design simple makeshift water purifiers out of ordinary charcoal and crushed Moringa seeds?

A research university that is learner-centred and that bridges faith and scholarship in the service of society, especially the poor: That is De La Salle University: Excellent by its own standards. Excellent for the common good.

*Arnulfo P. Azcarraga, Vice Chancellor for Research,
De La Salle University, Manila, Philippines*

De La Salle University opened its doors in 1911. Since then, it has been persistent in its commitment to the holistic development and education of its students who would eventually help in the development of the Philippines. Top-notch faculty members who are acknowledged experts in their respective fields help prepare Lasallians to be competent professionals and responsible citizens. De La Salle University builds on its tradition of excellence and service.

Academic excellence: The tip of the iceberg

Who defines excellence, for what purpose?

During the 1960s, science and technology (S&T) became an issue of policy in much of the developing world. Legislation to promote S&T was adopted in many countries and the first research councils were created. Governments were called upon to define national priorities for S&T. Scientific institutions were compelled to produce development plans, and scientists had to formulate project proposals with measurable targets in order to get funding. Bold scholarship schemes for graduate students were created with the aim to ensure the multiplicative effect of the investment in S&T. These measures, which on the whole had a positive impact on the development of science in the then-called “Third World”, were the outcome of national decisions. However, major drivers were the international financial institutions.

Also during those times, international cooperation received an important impulse, as it was identified as a mechanism to strengthen science in the developing world. Resources from development agencies in industrialised countries started to flow more freely towards universities and research groups in the South. Institutions were created to promote North-South collaboration – notably the International Centre for Theoretical Physics, ICTP – and existing organisations such as the Organization of American States (OAS) added S&T to their agenda.

As part of their plan to support the development of science in Latin American countries, the OAS strongly pushed for the establishment of regional “Centres of Excellence” (CEs). These institutions were intended to concentrate “the best of the best” in specific areas and selected countries. Some colleagues in the region embraced the idea with much enthusiasm. The majority, however, received it with apprehension. Several issues and questions contributed to this cold reception, among others:

- Resources (especially financial) for science are limited. Creation of a few CEs – which are necessarily resource-intensive – would therefore deprive many groups and institutions from badly needed funds.
- The selection of areas and countries for the establishment of CEs poses a problem. In a country or region where many research areas are weak (or absent), should an area that is already strong be further strengthened – or should other relevant areas be promoted instead?
- Is it a priority of science in Latin America (or rather, was it in those times) to excel in a limited number of fields, or rather to develop a more robust and distributed system

that encompasses all relevant areas of modern science?

- Last but not least: What is meant by “excellence” and who establishes the parameters to qualify for it?

In the end, the OAS plan did not go much further than establishing a few CEs. However, the debates that took place in the 1960s may have helped the Latin American community to realise that S&T development is a policy issue, and that regional and international scientific cooperation can become a powerful tool if it is properly addressed. To date, many scientists in the region – further to continuing their ties with their (normally stronger) peers in the North – engage in more horizontal collaborations with colleagues from neighbouring countries. In addition, the stronger countries have created programmes in support of the weaker ones so as to contribute to the scientific development of the region as a whole. The concept of CEs can hardly be considered to have played a relevant role for science in Latin America.

In the meantime, CEs in science have been created in other regions, with different purposes. For example, the Australian Research Council has established CEs as “prestigious hubs of expertise through which high-quality researchers maintain and develop Australia’s international standing in research areas of national priority”. Also, the South African Government identified the need to create “centres and networks of excellence in S&T, including in the social sciences, as a key component of the human capital and transformation dimensions of government policy”.

On the international scene, the Academy of Sciences for the Developing World (TWAS) has created an Associateship Scheme that is conducted in collaboration with more than 100 scientific institutions in the South, named “centres of excellence”. Mexican institutions taking part in this scheme are: Center for Genomic Sciences, Biotechnology Institute, Institute of Biomedical Research, Institute of Cellular Physiology, Institute of Chemistry, and Institute of Mathematics (all from UNAM), Centre for Research in Mathematics, A.C. (CIMAT) and Department of Infectomics and Molecular Pathogenesis (CINVESTAV). These institutions have been selected for a good reason: They have a recognised level of quality research and the capacity to host and collaborate with researchers from other countries. Fortunately, there are a number of other institutions in Mexico that could be added to this list. Being identified as a CE is therefore to a certain extent a matter of circumstance – or rather the result of an interest and willingness to participate in the scheme.

So, what is excellence? What makes a university “excellent”?

Excellence: superiority; eminence. The fact or state of excelling.
Excel: to surpass others or be superior in some respect or area; do extremely well.

Excellence is a talent or quality which is unusually good and so surpasses ordinary standards.

The examples mentioned above show that in practice the concept of “excellence” is somewhat looser than the dictionary might suggest. Of course we may agree that a first-class research university in the industrialised world, such as the ETH Zurich, is “excellent” by all standards. However, when discussing “excellence” more broadly, we must realise that the significance of the term becomes context-dependent: If not for other reasons, because excellence is defined by comparison. Excellence has a relative meaning, hence, there is no excellence if there are no others with which to compare.

Accepting this caveat, we may still ask ourselves: What makes an institution in the developing world “excellent”? A couple of important factors have been mentioned above: The political decision to create an institution that can play a leading role in its area of expertise, the funding needed for it... but obviously these are not sufficient – especially when (and where) political decisions provide no long-term guarantee. One might even argue that most institutions that are recognised today as “first-class” or “unusually good” were probably not created with this objective in the first place. Excellence is not something that can be created by decree or produced overnight. It is the result of a delicate, basically endogenous process. It requires nurturing a culture and an atmosphere of good quality research, where (i) scientists are at the same time expected and allowed to be creative, where (ii) students, young researchers and the older ones interact and work together, and where (iii) there is room for innovativeness, because by doing the same again and again (or the same that others have done), nothing is changed. It also requires institutional stability and continuity of support that are needed to build a solid tradition. International cooperation can help achieve and sustain academic excellence, but cannot replace the local conditions required for it.

A good case in point is the National University of Mexico (UNAM), which covers the entire range of disciplines, and in many of them is the reference institution on the regional level. It is not by chance that most of the Mexican CEs in the TWAS roster are part of UNAM. Its strength is not due to circumstance but is the result of a sustained effort, supported



Ana María Cetto

by a society that is aware of the benefits it receives in return, and by the State – with all its traditional limitations.

Of course, intellectual and academic leadership plays a role in achieving and maintaining this status. Therefore, one of the main challenges for the UNAM is to retain its leadership while constantly renewing itself. This is not an easy task in the present globalised era, in which private universities irrupt to dominate the scene, pushing for a different model – more adept to market economies, driven by business interests rather than knowledge creation. Another challenge for the UNAM is to play an effective leadership role by helping to strengthen the rest of the university system. Because one university, as large as it may be, cannot alone cover the needs of a country as large as Mexico.

This brings us back to the “excellence” issue as expressed in the title. In a metaphoric sense, excellence represents the tip of an iceberg, the most eminent part that draws the attention of any observer. But the tip would not exist were it not for the rest of the iceberg, including the large, mostly unobserved glacial mass underwater that sustains and provides stability to the dazzling mountain of ice.

Ana María Cetto, Instituto de Física,
National Autonomous University of Mexico

The National Autonomous University of Mexico (UNAM) was founded on September 21st, 1551 under the name *Royal and Pontifical University of Mexico*. It is the biggest and most important university in Mexico and Ibero-America. The fundamental aim of the UNAM is to serve both the country and humanity, train professionals, organise and carry out research, mainly on national problems and conditions, and offer cultural benefits in the broadest sense possible.

Balancing fundamental tertiary education needs with world-class aspirations

Strengthening higher education will benefit society and have a positive effect on economic growth and development. With ETH President Ralph Eichler, we discussed the role which ETH Zurich could play for tertiary education in developing countries.

Barbara Becker: Recent rankings show that the ETH Zurich is among the top 20 universities worldwide. For example, the Times Higher Education World University Rankings 2011–2012 ranked the ETH Zurich 15th as the only non-anglophone university among the top 20. Professor Eichler, why is it important for the ETH Zurich to be “world-class”? What role do rankings play in this respect?

Ralph Eichler: To be world-class it is important to attract talented students, excellent professors and committed donors. Some companies have contacted us because of our good rankings. Also students and professors are looking at the rankings.

Barbara Becker: Thus, the ETH Zurich seeks to be attractive for students?

Ralph Eichler: For the best students. Once I had a discussion with a colleague in Hong Kong on how to select these students. For him, this was not the relevant question. The relevant question is how we can make sure that the best students worldwide apply to the ETH Zurich instead of the Massachusetts Institute of Technology or Stanford University.

Barbara Becker: What do you think are ETH Zurich’s success factors?

Ralph Eichler: Autonomy, smart students and a stable budget. I am surprised that when I ask professors why they apply to the ETH Zurich they often mention that the ETH students are better than the students in other universities.

Barbara Becker: My feeling is that not only the quality of the students but also the inspiring research environment is very important: the colleagues, the interaction between them, and the freedom of scientific research.

Ralph Eichler: Yes exactly, this is what I meant using the term autonomy. Of course, the budget we provide for risky projects has an influence as well – risky not meaning dangerous, but risky in outcome. This budget allows

professors to experiment with their own money, without having to give feedback. With the resulting data they are able to apply to funding agencies with better chances to be selected because the risky part of their research is already done.

“There is no universal recipe or magic formula for ‘making’ a world-class university. [...] International experience provides a few lessons regarding the key features of such universities – high concentrations of talent, abundance of resources, and flexible governance arrangements [...]”¹

Barbara Becker: In your perception, what could universities in developing countries learn from the ETH Zurich?

Ralph Eichler: I believe that not necessarily individual universities could learn from the ETH Zurich. Rather, governments could learn from Switzerland with its dual education system. In my view, developing countries do not need world-class universities in the first place. What is much more needed is vocational training and a society which values people who have pursued vocational training. In China, as far as I know, many parents have only one goal: My child should visit a top university. The children who do not succeed in one of the top universities are rated as someone who has failed. This is wrong.



Capacity development to candidates from developing countries, managed by the North-South Centre, 2007–2011

Barbara Becker: What could be the role of the ETH Zurich with respect to supporting universities in developing countries in their efforts to gain academic excellence?

Ralph Eichler: Teach the teachers – this is what we should do. The collaboration with the Ethiopian Institute of Architecture, Building Construction and City Development in Addis Ababa, for instance, highlights several activities that could also be applied in another setting. First, an ETH Professor emeritus, Franz Oswald, developed together with his Ethiopian colleagues a new curriculum in architecture and urban design for the University of Addis Ababa. This led to the inauguration of the above-mentioned institute whose Founding Director, Dirk Hebel, was ETH scientist at the same time. Throughout the past years, several Ethiopian faculty members pursued on-the-job training in teaching at the Department of Architecture at the ETH Zurich. Regarding research, I see a possible support in providing universities with equipment for lab courses. While many scholars from developing countries have profound theoretical knowledge, they are lacking lab equipment and with that, experience in doing hands-on experiments.

Barbara Becker: With respect to research collaboration, how would you see the role of the ETH Zurich and the role of its partner institutions?

Ralph Eichler: If ETH scientists conduct research which should benefit developing countries, they need to collaborate with a local partner institution. Choosing such a partner university requires specific quality criteria and the acknowledgement that these universities are not all world-class institutions.

Barbara Becker: What would be your final message with regards to world-class research universities in developing countries?

Ralph Eichler: If developing countries strive to have world-class universities, this is dangerous – I believe. Striving to be world-class is only the second step they should take. Their first step should be to contribute to solving pressing problems in their home country. In China, for instance, the top universities such as Tsinghua and Tongji help develop the education system in the country. Furthermore, they should find solutions to the “real” and urgent problems such as lack of water, food and basic education.



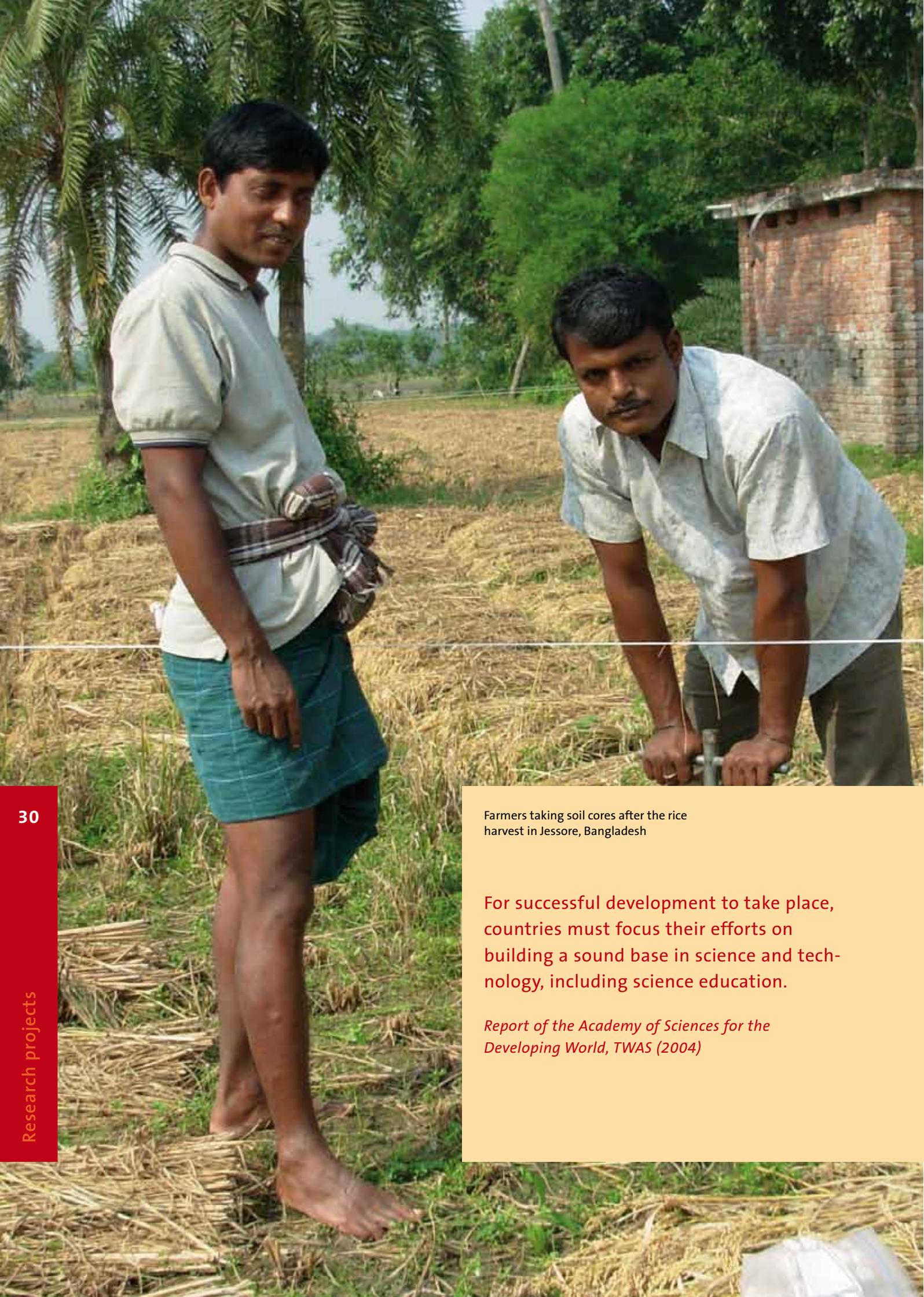
Ralph Eichler

“The [...] momentum behind the push for world-class universities must be examined within the proper context to avoid overdramatisation of the value and importance of world-class institutions [...]. Even in a global knowledge economy, [...] the hype surrounding world-class institutions far exceeds the need and capacity for many systems to benefit from such advanced education and research opportunities, at least in the short term. [...] Focusing efforts on the local community and economy, such institutions could lead to more effective and sustainable development than broader world-class aspirations.”²

¹ Salmi, J., 2009: *The Challenge of Establishing World-Class Universities*. The World Bank, Washington DC, USA: 12.

² *ibid.*: 13–14.

ETH Zurich has come to symbolise excellent education, groundbreaking basic research and applied results that are beneficial for society as a whole. Founded in 1855, ETH Zurich has more than 17 000 students from approximately 80 countries, 3 700 of whom are doctoral candidates. Today, it offers researchers an inspiring environment and students a comprehensive education as one of the world's leading universities for technology and the natural sciences. 21 Nobel Laureates have studied, taught or conducted research at ETH Zurich, underscoring the excellent reputation of the institution.



Farmers taking soil cores after the rice harvest in Jessore, Bangladesh

For successful development to take place, countries must focus their efforts on building a sound base in science and technology, including science education.

Report of the Academy of Sciences for the Developing World, TWAS (2004)

Research projects related to developing countries

More than 10% of all professors at the ETH Zurich pursue activities in or related to developing countries. The majority of them are members of the North-South Centre. A particularly great wealth of research is dedicated to food security and natural resource management. Many development-related research projects cut across disciplines and integrate colleagues from various institutes and departments.

It is our goal to emphasise the full research portfolio of the ETH Zurich related to developing countries independent of the diverse funding sources. We are assuming that the North-South related projects conducted by the members of the North-South Centre are a faithful reflection of the development-related research of the ETH Zurich. The lists on the following pages thus give account of the breadth and depth of this portfolio. The projects that are part of a North-South Centre managed programme have a reference to their detailed description on the respective page.

The individual projects are grouped according to the three thematic research areas food security, natural resource management, and urban and rural transformation. In addition, the overview is complemented by miscellaneous research projects that cannot be assigned to one of the three topics. Approximately half of the members of the North-South Centre belong to the departments of agricultural and food

sciences or environmental sciences. Therefore, it is not surprising that the majority of the projects belong to the research areas food security and natural resource management. Each member of the North-South Centre assigned his or her project to the most relevant research area. While the presented topics permit the assessment of the wealth of research in each particular field, they do not adequately reveal the interdisciplinary nature of most of the projects, nor the somewhat blurred delineations between the different research areas.

International Knowledge Base

In 2011, the ETH Zurich launched its International Knowledge Base (IKB). The platform is a repository for information on the international contacts of the ETH Zurich, its departments and individual research groups. As the users will provide additional information, this institutional knowledge will expand over time.
www.ikb.ethz.ch



Geographic distribution of research projects conducted by members of the North-South Centre in 2011

Food security

The real challenges in addressing global food insecurity

The question of how to feed the world, while considering human health, the environment and social well-being is really the defining, and possibly most complex challenge of our time. Today, there are over a billion undernourished people on the planet. A further billion suffer from “hidden hunger” resulting from a chronic lack of access to sufficient nutrients and vitamins. Many of these people are small-scale farmers in developing countries, a group representing nearly one third of humanity.

Addressing food security requires us to consider four components: (i) availability – through sustainable agricultural production and processing; (ii) access – to sufficient resources for acquiring appropriate and adequate (quantity and quality) food; (iii) use – utilisation of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being; and (iv) stability – providing stable food supplies under changing environmental, political and socio-economic conditions.

However, the environmental basis of food production is already facing unprecedented challenges, including climate change, increasing water scarcity, decreasing soil quality, declining land and input availability, emerging plant pests and pathogens and thus decreasing provision of ecosystem services. At the same time, a growing global population and changing dietary habits are placing record demands on the consumption side.

In 2009, the FAO released a study estimating that agricultural production would need to increase by 70% to feed the world in 2050. This estimate has kept the international debate focused on the intensification of agriculture to increase production yields – an approach which has for many years ignored the real challenges in addressing global food insecurity.

Interdisciplinary research is required to address the pressing underlying questions, such as: How can we design better production systems that respect the environment, maximise resource efficiency and benefit the society? How can we better link food production and processing to the objective of eradicating hunger and malnutrition? How do consumer behaviour and agricultural policies in the North impact hunger and rural poverty in the South? What can be done to reduce volatility in global food markets and the impacts on the most vulnerable?

These questions highlight the fact that global food availability is not the major limitation in reducing malnourishment and food insecurity in the developing world. We must consider the entire global food system and all four pillars that food security rests on in order to devise smart and sustainable solutions.

Nina Buchmann, Chair, and Michelle Grant, Executive Director, World Food System Center

Global food availability is not the major limitation in reducing malnourishment and food insecurity in the developing world.



Farmers filling threshed rice into gunny sacks in Jessore, Bangladesh

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Agricultural and Food Sciences (D-AGRL)				
Agri-food & Agri-environmental Economics				
Bernard Lehmann, Dominique Barjolle <i>see page 58</i>	Marc Zoss, <i>cand. doc</i> ; Janine Rüst, <i>MSc stud.</i>	Governance, collective action and development interventions in vegetable value chains in Tanzania. (08/08–07/12)	A. Tenkouano, World Vegetable Center, Tanzania; A. Temu, Sokoine University of Agriculture, Tanzania	Tanzania
Bernard Lehmann, Michael Siegrist <i>see page 65</i>	Hermann Comoé, <i>cand. doc</i>	Contribution to food security by improving farmers' responses to climate change in northern and central areas of Côte d'Ivoire. (02/10–01/13)	B. Bonfoh and D. Dao, CSRS, Côte d'Ivoire; M. Tanner, Swiss TPH, Switzerland; M. Dumondel and D. Barjolle, ETH Zurich, Switzerland	Côte d'Ivoire
Animal Nutrition				
Michael Kreuzer	Souheila Abbeddou, <i>cand. doc</i>	Improving small ruminant productivity in dry areas through cost-efficient animal nutrition and improved quality of milk and dairy products. (10/06–08/11)	B. Rischkowsky, L. Iñiguez and M.E. Hilali, ICARDA, Syria; H.D. Hess, ALP, Switzerland; A. Oberson and B. Lehmann, ETH Zurich, Switzerland	Syria
Svenja Marquardt, Michael Kreuzer <i>see page 70</i>	Shanker Barsila, <i>cand. doc</i> ; Andrea Buser, <i>BSc stud.</i>	Improving grazing systems with Nepalese yak crossbreds to foster livelihood of mountain farmers in the Taplejung district of Nepal. (09/09–08/12)	N.R. Devkota, Tribhuvan University, Nepal	Nepal
Svenja Marquardt, Michael Kreuzer	Janina Meier, <i>cand. doc</i>	Testing the concept of diversity in feeding in the tropics and subtropics: Effect of experience, adaptation and choice on feed selection, intake and foraging behaviour of sheep. (09/09–08/12)	B. Rischkowsky and M. Louhaichi, ICARDA, Syria; A. Abdalla, Nuclear Energy Center for Agriculture, Brazil; V. Rodrigues Vasconcelos, Universidade do Piauí, Brazil; A. Liesegang, University of Zurich, Switzerland	Syria, Brazil, Switzerland
Michael Kreuzer	Jana Müller	Feasibility and sustainability of vermiculture on locally produced organic wastes to promote income of Vietnamese small-scale farms with aquacultural activities. (06/10–01/11)	Tran Thi Nang Thu, Hanoi University of Agriculture, Vietnam; J. Pucher, University of Hohenheim, Germany; U. Focken, Johann Heinrich von Thünen-Institut, Germany	Vietnam
Applied Entomology				
Silvia Dorn		Population genetics of a devastating moth. (07/11–12/14)	M. Chen, Northwest A&F University, China	China

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Food Biotechnology				
Leo Meile	Christoph Jans, <i>cand. doc</i> ; Patrick Murigu Kamau Njage, <i>cand. doc</i> ; Martina Haug, <i>post-doc</i> ; Marc Stevens, <i>post-doc</i> ; D.W.M. Kaindi, <i>MSc stud.</i> , KARI, Kenya	Pathogenic streptococci in East African milk products: Prevalence, diversity and health hazards for children. (09/10–07/11)	J. Wangoh, University of Nairobi, Kenya; M. Younan, KARI, Kenya; B. Bonfoh, CSRS, Côte d'Ivoire	Kenya, Côte d'Ivoire
Leo Meile	Christoph Jans, <i>post-doc</i>	Elucidation of the role of African <i>Streptococcus infantarius</i> with regards to food safety and epidemiology. (11/11–12/11)	W. Kogi-Makau and D.W.M. Kaindi, University of Nairobi, Kenya; M. Younan, Kenyan Agricultural Research Institute; B. Bonfoh, CSRS, Côte d'Ivoire; J. Hattendorf, E. Schelling and J. Zinsstag, Swiss TPH; P. Renault, French National Institute for Agricultural Research Jouy en Josas, France	Kenya, Côte d'Ivoire
Human Nutrition				
Richard Hurrell, Rita Wegmüller	Siwaporn Pinkaew, <i>cand. doc</i>	Triple fortification of rice with iron, zinc and vitamin A. (01/08–05/12)	Mahidol University, Thailand	Thailand
Richard Hurrell, Ines Egli, Rita Wegmüller	Colin Cercamondi, <i>cand. doc</i> ; Marica Brnic, <i>cand. doc</i>	Novel staple food-based strategies to improve micronutrient status for better health and development in sub-Saharan Africa. (2008–2013)	Université d'Abomey-Calavi, Benin; Institut de Recherche en Sciences Appliquées et Technologies, Burkina Faso; Valid Nutrition Nairobi, Kenya	Benin, Burkina Faso, Kenya
Richard Hurrell, Rita Wegmüller	Dominik Glinz, <i>cand. doc</i>	Aetiology, prevention and control of anaemia in sub-Saharan Africa. (07/09–06/12)	Université de Cocody-Abidjan, Côte d'Ivoire; CSRS, Côte d'Ivoire	Côte d'Ivoire
Richard Hurrell, Ines Egli	Maren Fischer, <i>cand. doc</i>	Improving iron and zinc nutrition in Ethiopian children consuming injera based diets. (11/09–10/12)	Addis Ababa University, Ethiopia	Ethiopia
Richard Hurrell, Ines Egli	Nico Petry, <i>cand. doc</i>	Testing the efficacy of biofortified beans to improve iron status in Rwandan women. (2009–2011)	HarvestPlus	Rwanda
Richard Hurrell, Ines Egli		Malaria and the safety of iron interventions. (2009–2013)	G. Brittenham, Columbia University, USA; Mahidol University, Thailand	Switzerland, Thailand
Plant Nutrition				
Emmanuel Frossard		The role and management of Dioscorea species in home-gardens of smallholders' farms in Sri Lanka. (02/11–06/11)	R. Sangakkara, University of Peradeniya, Sri Lanka	Sri Lanka
Emmanuel Frossard, Jan Jansa, Hannes Gamper	Vajiheh Dorostkar, <i>cand. doc</i> , IUT, Iran	Arbuscular mycorrhizal symbiosis and wheat mineral nutrition in saline soils. (06/11–07/12)	A. Khoshoftarmamesh and M. Afyuni, IUT, Iran	Iran

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Biology (D-BIOL)				
Plant Biotechnology				
Wilhelm Gruissem, Hervé Vanderschuren	Isabel Moreno, <i>cand. doc</i> ; Evans Nyaboga, <i>cand. doc</i> , University of Nairobi, Kenya; Huahong Wang, <i>post-doc</i>	BiocassavaPlus (07/05–07/11)	IITA, Nigeria; CIAT, Colombia; University of Bath, UK; Donald Danforth Plant Science Center, USA	Nigeria, Uganda, Kenya, Tanzania
Wilhelm Gruissem, Hervé Vanderschuren	Kuan-Te Li, <i>cand. doc</i>	Biofortification of cassava and rice. (01/09–01/12)	T. Fitzpatrick, University of Geneva, Switzerland; P. Zhang, SIBS, China	Switzerland, China
Wilhelm Gruissem, Hervé Vanderschuren; Morag Ferguson, IITA, Kenya <i>see page 62</i>	Charles Orek, <i>cand. doc</i>	Characterisation of drought tolerance in Cassava (<i>Manihot esculenta</i> Crantz). (07/09–12/12)	J. Kamau, KARI, Kenya	Kenya
Wilhelm Gruissem, Hervé Vanderschuren <i>see page 66</i>	Ravi Bodampalli Anjanappa, <i>cand. doc</i>	Reducing the impact of cassava brown streak disease. (04/10–04/13)	M.M.N. Gowda, University of Greenwich, UK; E. Kanju, IITA, Tanzania	UK, Tanzania
Hervé Vanderschuren		Knowledge and technology transfer partnership: Cassava transformation platform establishment. (06/10–06/12)	Mikocheni Agricultural Research Institute, Tanzania; University of Bath, UK	Tanzania
Wilhelm Gruissem, Hervé Vanderschuren	Emily McCallum, <i>post-doc</i>	Molecular and genomic strategies to engineer durable and sustainable disease resistance to bacterial blight of cassava. (06/10–06/13)	B. Staskawicz, UC Berkeley, USA; A. Bernal, Universidad de Los Andes, Colombia	Colombia



Plant samples grown under phosphorus-deficient and drought stress conditions at IRRI, Philippines



Onions waiting to be procured by traders, Tanzania

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Wilhelm Gruissem, Navreet K. Bhullar <i>see page 68</i>	Jonghwa Park, <i>cand. doc</i>	Ancient genes for future rice. (02/11–01/14)	S. Heuer, IRRI, Philippines	Philippines
Wilhelm Gruissem, Hervé Vanderschuren <i>see page 73</i>	Ima Mulyama Zainuddin, <i>cand. doc</i>	Investigating molecular determinants for abiotic stress resistance in cassava. (08/11–08/14)	E. Sudarmonowati, Indonesian Institute of Sciences (LIPI), Indonesia	Indonesia

Civil, Environmental and Geomatic Engineering (D-BAUG)

Ecological Systems Design

Stefanie Hellweg	Carmen Mosquera, <i>cand. doc</i> , Universidad Nacional, Colombia; Alexander Erazo, <i>cand. doc</i> , Universidad Nacional, Colombia; Camilo Lesmes, <i>cand. doc</i> , University of Graz Austria; Ronnie Juraske, <i>post-doc</i>	Life cycle human exposure and risk assessment of pesticide application on agricultural products in Colombia. (05/09–05/12)	Universidad Nacional, Colombia; Universidad de Boyaca, Colombia; University of Graz, Austria	Colombia, Austria, Switzerland
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Environmental Sciences (D-UWIS)

Environmental Biogeochemistry, Eawag

Stephan Hug, Janet Hering and Andreas Voegelin, Eawag, Switzerland <i>see page 54</i>	Linda Roberts, <i>post-doc</i> , Eawag, Switzerland	Arsenic contamination of paddy soils in Bangladesh: Risks for wet season rice production in non-flooded and shallowly flooded soils. (05/10–12/11)	M.A. Ali and A.B.M. Badruzzaman, University of Engineering and Technology, Bangladesh; M.A. Hamid Miah, IRRI, Bangladesh; M.R. Islam, Agricultural University Bangladesh	Bangladesh
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Experimental yak with heart belt and pedometer devices, Nepal



Field-harvested cassava roots, Kenya

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Environmental Policy and Economics				
Marcella Veronesi		Climate change adaptation and food security in Ethiopia. (06/09–12/12)	S. di Falco, London School of Economics, UK	Ethiopia
Soil Protection				
Rainer Schulin, Emmanuel Frossard	Anja Gramlich, <i>cand. doc</i> ; Forough Aghili, <i>cand. doc</i> ; Susan Tandy, <i>post-doc</i> ; Mojtaba Norouzi, <i>cand. doc</i> and Vajiheh Dorostkar, <i>cand. doc</i> , IUT, Iran; Somayeh Ghasemi, <i>MSc stud.</i> and Hadi Habiby, <i>MSc stud.</i> , IUT, Iran	Agronomic biofortification to fight human zinc deficiency in arid regions. (03/09–01/13)	R. Hurrell, R. Wegmüller and J. Jansa, ETH Zurich, Switzerland; B. Nowack, Empa, Switzerland; M. Afyuni and A. Khoshgoftarmansh, IUT, Iran	Iran
Rainer Schulin; S. Beebout, IRRI, Philippines <i>see page 64</i>	Somayanda Impa Muthappa, <i>post-doc</i> , IRRI, Philippines	Healthy rice for healthy people: Biofortification of zinc in rice. (08/09–08/11)	A. Ismail, M.A. Bunquin and M.J. Morete, IRRI, Philippines; S. Tandy and A. Gramlich, ETH Zurich, Switzerland	Philippines
Humanities, Social and Political Sciences (D-GESS)				
NADEL				
Rolf Kappel	Jan Schüpbach, <i>cand. doc</i> ; Ivan Pavletic, <i>post-doc</i>	The impact of foreign direct investment in agriculture in developing countries: Selected aspects at the global level and country level. (08/10–12/13)		Zambia
Eawag				
System Analysis, Integrated Assessment and Modeling				
Hong Yang, Eawag, Switzerland; Bernhard Wehrli	Jafet Andersson, <i>cand. doc</i>	The potential impacts of enhanced soil moisture and soil fertility on smallholder crop yields in Southern Africa. (04/07–04/11)	G. Jewitt, University of KwaZulu-Natal, South Africa	Southern Africa
Hong Yang, Eawag, Switzerland; Rainer Schulin	Christian Folberth, <i>cand. doc</i>	Global agricultural green and blue water consumptive uses and virtual water flows in the context of water scarcity and climate change. (02/09–02/12)		Global

Natural resource management

Balancing the pressures on our planet's resources

According to the United Nations Population Fund, global human population surpassed 7 billion people on 31 October 2011, which coincidentally, and perhaps appropriately, happened to be Halloween day. As China and India's population will continue to expand over the next several decades, we are expecting an additional 2.3 billion people by 2050. These people will place greater demands on our planet's arable land, soil, water, forests and other natural resources. Furthermore, the production of first generation biofuel feedstock – such as oil palm, soy and sugarcane – to meet future energy needs will require additional land to be turned over to agriculture. Moreover, as production of food and energy increases, so would emissions of greenhouse gases. This, in turn, would exacerbate the anthropogenic and dangerous climate change. At the same time, many developing countries have to cope with the need to both grow their economies and protect remaining forests and biodiversity. It is no wonder that some scientists have warned of an impending “perfect storm” of multiple global crises.

A case in point is the worsening problem of tropical deforestation, which is a major source of greenhouse gas emissions and a leading cause of biodiversity loss. Indonesia is the world's second largest emitter of greenhouse gases from land use change and forestry, contributing to over one-quarter of global carbon emissions. The country also contains high concentrations of endemic species that are

threatened with extinction. Indonesia is, therefore, a global priority for actions to both reduce emissions and conserve biodiversity. In May 2010, Norway pledged US \$1 billion in support of a nation-wide REDD+ programme in Indonesia. REDD+ (Reducing emissions from deforestation and forest degradation) is a financial mechanism for avoiding deforestation by compensating land owners and land users for the value of carbon stored in forests that would otherwise be released to the atmosphere. The success (or failure) of the Norway-Indonesia partnership could be an early indication of outcomes in other forest-rich nations seeking REDD+ funds, such as the Democratic Republic of Congo and Colombia. Therefore, the Indonesian case study likely will have profound implications for climate change mitigation and conservation across the developing tropics.

The challenges facing humans in the coming decades are cross-scale, transcultural, and transdisciplinary, and likewise must be the strategies being developed to meet these challenges. Ultimately, scientists play a crucial role in helping decision-makers to achieve a careful balance of the various priorities within each society – a balance, which is needed to secure a sustainable development for the benefit of both humans and the environment.

*Lian Pin Koh,
Assistant Professor of Applied Ecology and Conservation*

The challenges facing humans in the coming decades are cross-scale, transcultural, and transdisciplinary, and likewise must be the strategies being developed to meet these challenges.



Groundwater-dependent vegetation in the bed of the ephemeral Ugab River, Namibia

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Agricultural and Food Sciences (D-AGRL)				
Animal Nutrition				
Florian Leiber, Michael Kreuzer	Anuraga Jayanegara, <i>cand. doc</i>	Impact of increasing the complexity of forage composition in ruminant feed on ruminal biohydrogenation and methanogenesis. (12/08–11/11)	S. Marquardt and C.S. Soliva, ETH Zurich, Switzerland; E. Wina, Indonesian Research Institute for Animal Production	Switzerland, Indonesia
Svenja Marquardt, Michael Kreuzer	Marco Sousa, <i>post-doc</i>	Characterization of the adaptive traits of local cattle and assessment of product quality to promote the sustainable management of the dry forest ecosystems of Latin America. (03/11–02/14)	H. Alzérreca, external consultant; J.N. Joaquin, Universidad Autónoma Gabriel René Moreno, Bolivia; Museo de Historia Natural Noel Kempff Mercado, Bolivia; M. Clauss, University of Zurich, Switzerland	Bolivia
Applied Entomology				
Silvia Dorn, Karsten Mody <i>see page 67</i>	Judith Riedel, <i>cand. doc</i>	Exploiting beneficial insects and defensive plant traits to limit pest damage and support growth of native timber trees in Panama. (05/10–04/13)	C. Potvin and H. Barrios, Smithsonian Tropical Research Institute, Panama	Panama
Plant Nutrition				
Emmanuel Frossard; M.P. Sedogo, Université Polytechnique de Bobo-Dioulasso; François Lompo, INERA, Burkina Faso <i>see page 61</i>	Delwendé Innocent Kiba, <i>cand. doc</i>	Impact of organic amendments on the phosphate nutrition of crops and on phosphate transformations in lixisols from semi-arid West Africa. (05/09–05/12)	S. Koala, CIAT, Kenya; Michel Dumondel and Martijn Sonneveld, ETH Zurich, Switzerland	Burkina Faso, Kenya, Ghana
Emmanuel Frossard, Astrid Oberson	Maike Nesper, <i>MSc stud.</i> ; Django Hegglin, <i>MSc stud.</i>	Phosphorus status in pastures established on highly weathered tropical soils of Caquetá, Colombia. (07/10–05/12)	I.M. Rao, P. Lavelle and S. Fonte, CIAT, Colombia; J. Velasquez and B. Ramirez, Universidad de la Amazonia, Colombia	Colombia
Emmanuel Frossard, Else Bünemann, Astrid Oberson	Lalajaona Randriamanantsoa, <i>cand. doc.</i> ; Oliver Zemek, <i>cand. doc</i>	Nutrient use and dynamics in conservation agriculture including legumes in the Midwest of the Malagasy highlands. (09/10–08/13)	L. Rabeharisoa, Laboratoire des Radio Isotopes, Madagascar; J. Rakotoarisoa, FOFIFA, Madagascar	Madagascar
Civil, Environmental and Geomatic Engineering (D-BAUG)				
Ecological Systems Design				
Stefanie Hellweg, Roland Scholz; Thomas Köllner, University of Bayreuth, Germany <i>see pages 76–79</i>	Michael Curran, <i>cand. doc.</i> ; Francesca Verones, <i>cand. doc.</i> ; Laura de Baan, <i>cand. doc.</i> ; Karin Bartl, <i>post-doc.</i> ; Michael Eisenring, <i>MSc stud.</i>	Assessing and compensating the ecosystem impacts of agricultural products in the North-South context – myEcosystem. (09/09–09/12)	UNEP, Kenya; University of Bayreuth, Germany	Peru, Kenya

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Groundwater and Hydromechanics				
Wolfgang Kinzelbach	Philipp Meier, <i>cand. doc</i>	Modelling of runoff and flooding in the Kafue flats, Zambia. (2006–2012)	ZESCO, Zambia; CCES, ETH Domain, Switzerland	Zambia
Alan Green, Wolfgang Kinzelbach	Joel Podgorsky, <i>cand. doc</i>	Salt water fingering in the Okavango Delta. (2006–2013)	Geological Survey of Botswana	Botswana
Wolfgang Kinzelbach	Ning Li, <i>cand. doc</i>	Modelling and model uncertainty in the management of water resources of the Yanqi Basin. (2010–2013)	Xinjiang Agricultural University, China; Xinjiang Department of Water Affairs, China; China Institute of Geological Environmental Monitoring	China
Wolfgang Kinzelbach	Florian Köck, <i>cand. doc</i>	Multi-objective optimization of the hydropower dam operation along the Kafue in a real-time control framework. (2011–2014)	ZESCO, Zambia; CCES, ETH Domain, Switzerland	Zambia
Hydrology and Water Resources Management				
Francesca Pellicciotti	Silvan Ragettli, <i>MSc stud.</i> ; Cyrill Bürgi, <i>MSc stud.</i>	Modelling the impact of a changing climate on basin ecosystems and sediment transport in the dry Andes of Chile and in the Swiss Alps: A comparative study. (12/10–03/11)	J. McPhee, University of Chile; M. Konz, Institution of Civil Engineers, UK; D. Molnar, ETH Zurich, Switzerland	Chile
Environmental Sciences (D-UWIS)				
Applied Ecology and Conservation				
Lian Pin Koh	Janice S.H. Lee, <i>cand. doc</i>	Modelling land use for decision support in the context of biofuel expansion. (06/09–10/12)	J. Ghazoul, ETH Zurich, Switzerland; CIFOR, Indonesia; Musim Mas Group Plantations, Indonesia; Institute Pertanian Bogor, Indonesia; National University of Singapore	Indonesia
Lian Pin Koh		Environmental iTools: Mobile applications for land use decision support in developing countries. (12/10–12/11)	Odeon Consulting Group, Singapore; Musim Mas Group Plantations, Indonesia; Wildlife Works Carbon, Kenya	Switzerland, Singapore, Indonesia, Kenya
Lian Pin Koh	Zuzana Burivalova, <i>cand. doc</i> ; Sinan Ayad Abood Itraija, <i>post-doc</i>	Comprehensive tradeoff analyses of the environmental and socioeconomic implications of alternative land use and development scenarios in the developing tropics. (06/11–05/15)	UNEP-UN REDD Programme; Musim Mas Group Plantations, Indonesia; National University of Singapore; Institute Pertanian Bogor, Indonesia; CIFOR, Indonesia; World Conservation Monitoring Centre, UK	Indonesia, DR Congo, Colombia, and others
Lian Pin Koh	John Garcia Ulloa, <i>cand. doc</i>	Comprehensive tradeoff analysis of REDD+ (Reducing emissions from deforestation and forest degradation) implementation. (08/11–02/15)	UNEP-UN REDD Programme	Indonesia, DR Congo, Colombia

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Aquatic Chemistry, Eawag				
David Senn, Bernhard Wehrli, Alfred Wüest	Philip Meier, <i>cand. doc</i> ; Claudia Casarotto, <i>cand. doc</i> ; Roland Zurbrügg, <i>cand. doc</i> . and Manuel Kunz, <i>cand. doc</i> , Eawag, Switzerland; Thomas Simfukwe, <i>MSc stud.</i> ; Jason Wamalume, <i>MSc stud.</i> , University of Zambia	African Dams Project (ADAPT) (2008–2012)	T. Bernauer, W. Blaser, P. Edwards, R. Kappel, W. Kinzelbach and H. Olde Venterink, ETH Zurich, Switzer- land; A. Schleiss, EPFL, Switzer- land; H. Chabuela, G. Shanungu and I. Nyambe, University of Zambia; ZESCO, Zambia	Zambia, Zimbabwe, Mozambique
Aquatic Physics, Eawag				
Alfred Wüest; Martin Schmid, Eawag, Switzerland	Kelly Ann Ross, <i>cand. doc</i> , Eawag, Switzerland; Fabrice Muvundja, <i>cand. doc</i> , DR Congo; Augustin Gafasi, <i>MSc stud.</i> , KIST, Rwanda	Lake Kivu: Learning from the past for managing its future. (06/09–06/12)	P. Isumbisho, ISP Bukavu, DR Congo; T. Nkurunziza, KIST, Rwanda; M. De Batist, Ghent University, Belgium; F. Anselmetti, Eawag, Switzerland	DR Congo, Rwanda
Ecosystem Management				
Jean-Pierre Sorg, Maik Rehnus; Bronislav Ivanovitch Venglovsky and Davlet Mamadjanov, National Academy of Sciences, Kyrgyzstan		Biodiversity and sustainable management of Kyrgyzstan's walnut-fruit forests: development of new silvicultural concepts (ORECH-LES). (2001–2011)		Kyrgyzstan
Jaboury Ghazoul	Aline Finger, <i>cand. doc</i> ; Chris Kettle	Ecological and genetic restoration of inselberg plant populations. (04/08–04/11)	Ministry of Environment, Seychelles	Seychelles
Jaboury Ghazoul, Jean-Pierre Sorg, Hans-Rudolf Felber; Gabrielle Rajoelison, ESSA, Madagascar <i>see page 59</i>	Zora Lea Urech, <i>cand. doc</i> ; Mihajamanana Fetra Rabenilalana, <i>cand. doc</i> , ESSA, Madagascar	The importance of forest fragments in local livelihood systems. (09/08–12/11)	J.-L. Pfund, CIFOR, Indonesia; E. Andriamapandry, Association Intercooperation Madagascar	Madagascar
Chris Kettle, Jaboury Ghazoul	Sascha Ismail, <i>cand. doc</i>	Impact of forest fragmentation and invasive species on gene flow among tropical trees. (10/08–10/11)	Forest Research Centre, Malaysia; University of Aberdeen, Scotland	India
Jaboury Ghazoul	Claire Tito de Morais, <i>cand. doc</i> ; Chris Kettle	Genetic processes underlying species coexistence in tropical rain forests: Is competition intensity shaped by genetic relatedness? (10/10–10/13)	Forest Research Centre, Malaysia; University of Aberdeen, Scotland	Malaysia
Jaboury Ghazoul, Jean-Pierre Sorg; Jerome Lewis, University College London, UK <i>see page 69</i>	Olivia Rickenbach, <i>cand. doc</i> ; Melanie Bachmann, <i>MSc stud.</i>	Forest dwellers and biodiversity in the context of industrial forestry: Looking for a win-win collaboration. (10/10–10/13)	CIFOR, Indonesia; CIFOR, Cameroon; Interholco AG (IFO Danzer), Switzerland	DR Congo
Jaboury Ghazoul, Chris Kettle; David Burslem, University of Aberdeen, Scotland	James Smith, <i>cand. doc</i>	Scaling biodiversity to ecosystem services: spatial genetic structure and carbon sequestration potential in tropical forest trees. (11/11–11/14)		Malaysia

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Environmental Philosophy				
Christian Pohl	Karin Payet, <i>cand. doc</i> , University of Stellenbosch, South Africa	Effective coastal conservation planning in South Africa. (01/11–06/11)	M. Rouget, University of Pretoria, South Africa; B. Reyers, Council for Scientific and Industrial Research, South Africa; M. Driver, South African National Biodiversity Institute; P. Desmet, private consultant, South Africa	South Africa
Environmental Policy and Economics				
Stefanie Engel; Charles Palmer, London School of Economics, UK		The effectiveness of community conservation agreements in the periphery of Lore Lindu National Park in Sulawesi, Indonesia. (2006–2011)	A. Pfaff, Duke University, USA	Indonesia
Stefanie Engel; Charles Palmer and Luca Taschini, London School of Economics, UK		Designing payments for environmental services under uncertainties. ClimPol sub-project. (01/08–12/11)	CCES, ETH Domain, Switzerland	Brazil, Kenya
Stefanie Engel; Charles Palmer, London School of Economics, UK	Saraly Andrade de Sa, <i>cand. doc</i>	Ethanol production impacts on land use and deforestation. (02/09–10/11)	C. Opal, Roundtable on Sustainable Biofuels/EPFL, Switzerland; S. Wunder, CIFOR, Brazil; P. Moutinho, Amazon Environmental Research Institute, Brazil; L. Abreu, EMBRAPA ambiente, Brazil	Brazil
<i>see page 60</i>				
Stefanie Engel	Devesh Rustagi, <i>post-doc</i>	The merits of a leader-based punishment institution in the provision of public goods. (07/10–12/11)	G. Gubissa, Oromia Forest Enterprises Supervising Agency, Ethiopia; GTZ SUN, Ethiopia; G. Manske and F. Gatzweiler, ZEF, Germany	Ethiopia
<i>see page 55</i>				
Stefanie Engel	Tim Schlöndorn, <i>cand. doc</i> ; Astrid Zabel, <i>post-doc</i> Marcella Veronesi	Establishing permanence in REDD+ schemes. (10/10–04/12)	Wild Life Works Carbon Ltd.	Kenya
Stefanie Engel	Tim Schlöndorn, <i>cand. doc</i>	CiVi.net–EU FP7 project. (10/10–09/13)	ZALF, Germany	Brazil, Costa Rica
Stefanie Engel	Tilman Silber, <i>MSc stud.</i>	Restoration of degraded peatlands in Southeast Asia: can the private sector do the job? (11/10–04/11)	H. Joosten, University of Greifswald, Germany; Wetlands International, Netherlands	Indonesia
Stefanie Engel	Symphorien Ongolo Assogoma, <i>cand. doc</i>	The REDD mechanism and 'fragile states'. Political economy of avoided deforestation in forested countries of Central Africa and related challenges. (10/11–09/14)	Alain Karsenty, CIRAD Montpellier, France; CIFOR, Cameroon	Cameroon, DR Congo

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Plant Ecology				
Christoph Küffer		Mountain Invasion Research Network (MIREN). (Since 2005)	http://www.miren.ethz.ch/people/index.html	Australia, Chile, India, South Africa, Spain, Sweden, USA
Christoph Küffer	Jialin Zhang, <i>cand. doc</i>	Biogeographic comparisons of native and invasive floras on oceanic islands. (11/09–09/13)		Global
Christoph Küffer	Marine Beaud, <i>MSc stud.</i> , Christoph Benkler, <i>MSc stud.</i> , Roland Bürki, <i>MSc stud.</i>	Functional ecology of the native and invasive flora of Seychelles. (06/10–12/12)	Seychelles National Parks Authority; Seychelles Ministry of Environment; Plant Conservation Action group of Seychelles; Nature Protection Trust of Seychelles; C. Kaiser-Bunbury, Aarhus University, Denmark	Seychelles
Peter Edwards, Harry Olde Venterink	Gurbir Singh Bhullar, <i>post-doc</i>	Reduction of methane emission from rice paddies through intercropping. (01/11–07/11)	IRRI, India; IRRI, Philippines; Institute of Soil Sciences, Chinese Academy of Sciences, China	India
Society, Environment and Culture				
Klaus Seeland, Peter Edwards	Franz Huber, <i>cand. doc</i>	What defines sustainability? An ecological and societal analysis of wild medicinal plant and mushroom collection in the Hengduan Mountains, Southwest China. (04/09–04/12)		China
Humanities, Social and Political Sciences (D-GESS)				
NADEL				
Rolf Kappel, Wolfgang Kinzelbach	Li Haitao, <i>post-doc</i>	Water management for sustainable agriculture in the Yanqi Basin, China. (01/09–12/12)	China Institute of Geological Environmental Monitoring; Agricultural University Urumqi, China; Water Authority of Xinjiang, China	China
Economic Research				
Renate Schubert		Global climate change – technological and institutional innovations. (2008–2011)	WBGU, Germany; J. Blasch, ETH Zurich, Switzerland	Global
Renate Schubert		Financing the energy transition. (2011–2012)	WBGU, Germany; J. Blasch, ETH Zurich, Switzerland	Global
Eawag				
System Analysis, Integrated Assessment and Modeling				
Hong Yang, Eawag, Switzerland	Shouke Wie, <i>post-doc</i>	Determination of environmental flow requirement and its safeguard measures in the Wei River in China. (07/09–09/11)	Beijing Normal University, China	China

Urban and rural transformation

Urbanisation without cities

The “rural” is usually defined as areas in the countryside which are not urbanised and show low population density. Typically, much of the land is devoted to agriculture. In developing countries worldwide, migration from rural areas towards cities has continuously increased over the past decades. People expect better living conditions in cities and better access to water, energy and a sanitary infrastructure as well as information. Also, chances for education and personal development are usually within range.

However, with the introduction of new autonomously operating communication, energy and sanitary infrastructures all of this traditional understanding is in flux. These infrastructures are no longer bound to a concept of scale, space or a national grid. A farmer with a mobile phone living in the most remote corner of Africa using a solar panel for energy production could therefore be considered part of an urbanised environment. Urbanisation is thus no longer just a question of density of people, streets or buildings. It is also a question of density of autonomously operating communication and energy units, which make information exchange, education, and entrepreneurial thinking possible.

Today, the most densely populated territory worldwide is a rural area in the northern part of India – not a single city. This fact illustrates the new situation architects and planners are confronted with and that forces them to re-

flect on a new concept of the “urban”. So far, the urban was understood as a centralisation of the most important commodities to prevent long distances for nationally operated infrastructures. Now, the urban could be an accumulation of small autonomously operating units. Rural and urban would no longer be opposing entities. Instead, one would be part of the other creating a whole new idea of interconnections and linkages in a non-hierarchical network of exchange. Hybrid terms, such as “urban farming”, already show that tendency.

Such a new understanding of the rural and the urban challenges the established model of a city and creates options for new synergies between these two. No doubt, most developing countries need to be urbanised, but maybe there are new models to achieve urbanisation – without building cities as they are traditionally understood. Set up by the ETH Zurich and Singapore’s National Science Foundation, The Future Cities Laboratory (www.futurecities.ethz.ch) located in Singapore provides a platform to reflect in transdisciplinary groups on the future understanding of the urban environment.

*Dirk Hebel, Assistant Professor of
Architecture and Building Construction*

So far, the “urban” was understood as a centralisation of the most important commodities to prevent long distances for nationally operated infrastructures. Now, the urban could be an accumulation of small autonomously operating units.



Low-cost, low-powered, connected laptops, loaded with educational software, supplied to children in the Solomon Islands

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Architecture (D-ARCH)				
Architecture and Design				
Dietmar Eberle, Margrit Hugentobler <i>see page 71</i>	Andrea Gerlinde Hagn, <i>cand. doc</i>	Informal settlements of the urban poor in a small Indian city: The relationship between spatial, structure socio-economic characteristics and access to the Jawaharlal Nehru National Urban Renewal Mission's sub-project Basic Services to the Urban Poor. (10/10–09/13)	C. Schmid, ETH Zurich, Switzerland; S. Banerjee-Guha, Tata Institute of Social Sciences, India	India
Architecture and Building Construction				
Dirk Hebel; Elias Yitbarek, EiABC, Ethiopia <i>see pages 74 – 75</i>		Building a sustainable rural dwelling unit (SRDU) in Ethiopia. (09/10–10/12)	Bete-Guraghe Cultural Centre, Ethiopia; Guraghe Administration Zone, Ethiopia	Ethiopia
Humanities, Social and Political Sciences (D-GESS)				
NADEL				
Isabel Günther	Elena Gross, <i>cand. doc</i> , University of Göttingen, Germany	Effectiveness and impact of water infrastructure programs. (01/09–12/11)	University of Amsterdam, Netherlands; Amsterdam Institute for International Development, Netherlands; KfW Entwicklungsbank, Germany; Policy and Operations Evaluation Department, Netherlands; Centre Régional pour l'Eau Potable et l'Assainissement, Benin	Benin
Isabel Günther	Elizabeth Tilley, <i>cand. doc</i>	Economic feasibility and behavioural change of urine collection, transport and processing. (10/10–10/14)	Eawag-Sandec, Switzerland; eThekweni Water and Sanitation, South Africa; Bill and Melinda Gates Foundation, USA	South Africa
Isabel Günther	Alexandra Horst, <i>cand. doc</i> ; Japheth Kwiringira, <i>cand. doc</i> , Makerere University, Uganda	Demand for and maintenance of sanitation in urban slums (U-ACT). (04/11–04/14)	Eawag-Sandec, Switzerland; Makerere University, Uganda; Sustainable Sanitation and Renewable Water Systems, Uganda; SPLASH, European Union	Uganda

Further research themes

An overview of scientific responses to global and local challenges

Geopolitical shifts and competition for limited resources such as space, raw materials, energy and food are some of the most prevailing global challenges. Furthermore, the inequality among citizens within societies and between nations is constantly increasing. Along with the financial, environmental and political instability, we are left with no choice but to be alert and responsive in search for solutions to these diverse problems at a global, regional and local scale. In that respect, research and innovation are crucial for sustainable development for human well-being.

Complementing the wealth of projects presented under the headings of food security, natural resource management, and urban and rural transformation, the members of the North-South Centre conduct research in many additional thematic areas. Amongst others, they are investigating challenges related to climate change adaptation, disaster risk mitigation and renewable energies. Further projects are exploring aid effectiveness and communication of research findings. All their new insights, technologies, models, and solutions are essential for addressing the complex and interrelated challenges developing countries are confronted with.

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New insights, technologies, models, and solutions are essential for addressing the complex and interrelated challenges in developing countries.



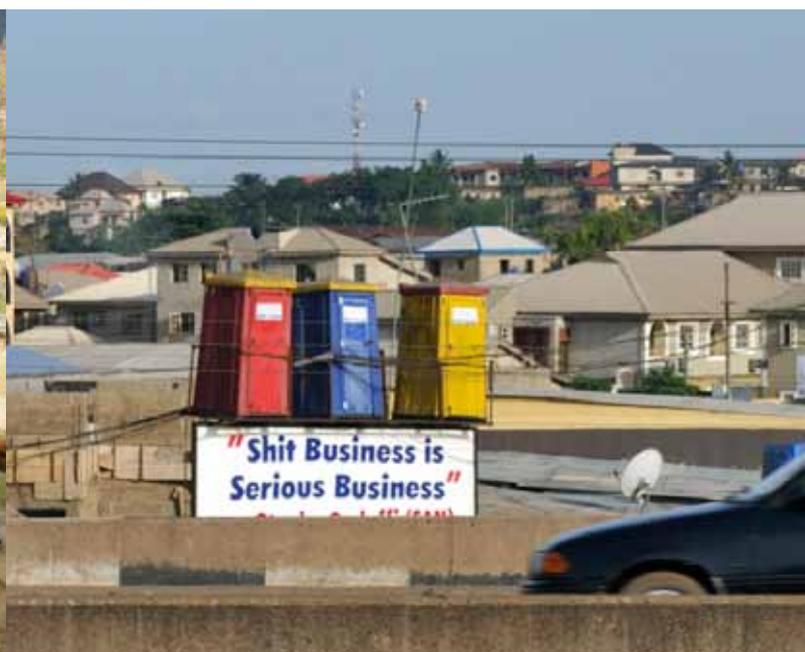
Sugarcane fields, which compete with other possible land uses – including forests, São Paulo State, Brazil

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Earth Sciences (D-ERDW)				
Engineering Geology				
N.M.S.I. Arambepola, Asian Disaster Preparedness Center, Thailand; Rajinder Bhasin, Norwegian Geotechnical Institute, Norway		RECLAIM III: Asian program for regional capacity enhancement for landslide impact mitigation. (2010–2012)	A. Kos, ETH Zurich, Switzerland	Thailand
Rajinder Bhasin, Norwegian Geotechnical Institute, Norway; Boop Singh, Ministry of Science and Technology, India		Department of Science and Technology – Norwegian Geotechnical Institute India-Norway institutional cooperation project. (2010–2013)	A. Kos, ETH Zurich, Switzerland	Norway, India
Geochemistry and Petrology, High Pressure Group				
György Hetényi		Earthquake hazard mapping in Bhutan. (07/10–06/12)	W. Roder and N. Tshering, Helvetas, Bhutan; D. Drukpa and J. Chopel, Department of Geology and Mines, Bhutan; R. Cattin and T. Berthet, Université Montpellier 2, France	Bhutan
Environmental Sciences (D-UWIS)				
Environmental Philosophy				
Gertrude Hirsch Hadorn	Gabriela Wuelser, <i>cand. doc.</i> ; Christian Pohl	Structuring the science-policy nexus in sustainability research. (04/08–03/12)	H. Wiggering, ZALF, Germany; B. Hubert, French National Institute for Agricultural Research and École des Hautes Études en Sciences Sociales, France; G. Bammer, Australian National University, Australia; A. Wiek, Arizona State University, USA; U. Wiesmann, University of Bern, Switzerland	Global
Environmental Policy and Economics				
Stefanie Engel	Pan He, <i>cand. doc.</i> ; Marcella Veronesi	Improving the design of payments for adopting renewable energies in China. (09/10–08/13)	M. Bennet and J. Xu, Peking University, China	China
Marcella Veronesi		Climate risk adaptation and insurance in the Caribbean. (08/11–08/14)	K. Warner, United Nations University	Jamaica

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Natural and Social Science Interface				
Roland W. Scholz	Monica Berger-Gonzalez, <i>cand. doc</i>	Maya and contemporary conceptions of cancer: Cultural formation of environmental literacy. (09/10–08/13)	C. Renner, University Hospital Zurich, Switzerland; S. Taquira Sipac, Mayan Council of Elders, Guatemala; W. Guerra, Instituto Nacional de Cancerologia Guatemala; A. Alvarez, Universidad del Valle de Guatemala; T. Kolly, Swiss Embassy, Guatemala; J. Zinsstag, Swiss TPH, Switzerland	Guatemala
Plant Ecology				
Angelika Hilbeck	Juanita Schläpfer-Miller; Eugenio Tisselli	Communication of coping and adaptation strategies for climate change in tropical regions in East Africa. (01/11–03/12)	Dar es Salaam University, Tanzania; Zurich University of Applied Arts, Switzerland	Tanzania
Humanities, Social and Political Sciences (D-GESS)				
NADEL				
Isabel Günther	Jonathan Gheysens, <i>cand. doc</i>	Risk preferences in poor rural environments. (07/10–07/12)	University of Abomey-Calavi, Benin; University of Parakou, Benin	Benin
Isabel Günther	Laura Metzger, <i>cand. doc</i>	New perspectives on aid effectiveness. (10/10–03/14)	KfW Entwicklungsbank, Germany	Global



Researcher Dawchu Drukpa preparing the instruments for geophysical measurements, Bhutan



A mobile toilet initiative born out of health and environmental concerns created by the lack of public toilets, Lagos, Nigeria

Project leader(s)	Researcher(s)	Project title (Duration of project)	Project partners	Countries
Mechanical and Process Engineering (D-MAVT)				
Energy Science and Engineering				
Christoph R. Müller <i>see page 72</i>	Abera Melesse Ayalneh, <i>cand. doc</i>	Energy conversion of coffee husk: fluidisation dynamics and reaction engineering. (10/11 – 11/14)	A. Venkata Ramayya, Jimma Institute of Technology, Ethiopia	Ethiopia
ETH Zurich/University of Zurich				
Center for Comparative and International Studies				
Katharina Michaelowa	Sophia Limpach-Hännly, <i>cand. doc</i>	Aid and democratization (09/06 – 12/11)	A. Bächtiger, University of Bern, Switzerland	Global
Katharina Michaelowa	Franziska Spörri, <i>cand. doc</i>	Aid effectiveness / Political economy of aid. (09/06 – 12/14)	A. Dreher, University of Göttingen, Germany; J. Faust, German Development Institute, Germany	Global
Katharina Michaelowa	Nadim Schumann, <i>cand. doc</i> ; David Zumbach, <i>cand. doc</i> ; Sebastian Fehrler, <i>post-doc</i>	Education policy in sub-Saharan Africa and other developing countries. (09/06 – 12/14)	J. Bourdon, University of Burgundy, France; M. Frölich, University of Mannheim, Germany; P. Gonon and M. Maurer, University of Zurich, Switzerland	Global
Katharina Michaelowa	Aliya Khawari, <i>cand. doc</i>	The political economy of microfinance. (01/09 – 06/12)	P. Finke, University of Zurich, Switzerland; I. Günther, ETH Zurich, Switzerland; Network of Entrepreneurship and Economic Development, India; Kashf Foundation, Pakistan	Pakistan, India
Katharina Michaelowa, Stefanie Bailer	Florian Weiler, <i>cand. doc</i> ; Paula Castro, <i>post-doc</i> ; Axel Michaelowa	Negotiating climate change. (09/09 – 12/11)	L. Andonova, IHEID, Switzerland; B. Ryf, University of Zurich, Switzerland; C. Bals, Germanwatch, Germany	Global
Katharina Michaelowa	Linda Maduz, <i>cand. doc</i>	Analyzing the causes of welfare state development in East Asia. (09/09 – 08/12)	H. Kriesi and S. Trakulhun, University of Zurich, Switzerland	Indonesia, South Korea, Thailand
Katharina Michaelowa	Daisuke Hayashi, <i>cand. doc</i> ; Martin Stadelmann, <i>cand. doc</i> ; Paula Castro, <i>post-doc</i> ; Axel Michaelowa	International climate policy. (ongoing)	Öko-Institut, Germany; Perspectives GmbH, Germany; Ecologic Institute, Germany; Stockholm Environment Institute, Sweden; Point Carbon, Norway; VW-Project, Lead University of Darmstadt, Germany	Developing countries



Ribonucleic acid extraction of rice roots at IRRI, Philippines

Good-quality and relevant higher education is a key to stimulating innovations in new varieties of crops, new materials, or sources of energy that would facilitate progress toward reducing poverty, achieving food security, and improving health.

Yaw Ansu, former Sector Director, Human Development, Africa Region, The World Bank (2010)

Programmes managed by the North-South Centre

The North-South Centre manages a series of programmes by which individual projects of its members are co-funded or otherwise supported. Some of these programmes have been ongoing for many years, while others are more recent initiatives.

Dating back to 1994, the SDC-funded contract on international agriculture is our most long-standing programme. Since 2003, it has focused on livestock systems research in support of poor people. As most of the projects in this programme were concluded in 2010 or 2011, we are synthesising the programme in this year's annual report. In spring 2011, SDC granted a contract extension until the end of 2012. This extension permits the funding of short-term activities conducted by our members.

The North-South Centre is investing in the capacity development of young scientists with two externally funded fellowship programmes. The Research Fellow Partnership Programme for Agriculture, Forestry and Natural Resources (RFPP) is funded by SDC. It covers doctoral and postdoctoral projects on food security and natural resource management.

Since 2009, the "Sawiris Scholarships – Science & Technology for the South" complement the RFPP. Donated by the Sawiris Foundation for Social Development, these scholarships are open to doctoral candidates of all disciplines at the ETH Zurich. The goal of the programme is to promote the development of products or methods which are directly relevant for improving the livelihoods of poor people in developing countries.

In 2011, the Arthur Waser Foundation funded a one-year pilot project in the area of rural housing in Ethiopia. It led to a three-year fellowship programme starting in 2012, which allows an in-depth investigation of the topic.

The North-South Centre is responsible for a Memorandum of Understanding (MoU) between the United Nations Environment Programme (UNEP) and the ETH Zurich. The interdisciplinary research project "myEcosystem" was implemented under this MoU and commenced in 2009.

Finally, funds by the ETH Zurich and SDC enable the North-South Centre to provide its members with small grants as seed money for new partnerships. Additional short-term activities being supported are visiting scientists from developing countries or teaching stays at universities in developing countries.

Livestock systems research	52
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RFPP fellowships	56
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Partnership with the Arthur Waser Foundation	74
Research collaboration with UNEP	76
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Reflecting on the livestock systems research programme

Last year, the North-South Centre commissioned a review to the ETH agro-economist Martijn Sonneveld to analyse the impact of the livestock systems research programme funded by the Swiss Agency for Development and Cooperation (SDC). The study is based on an analysis of existing reports and assessments as well as on various interviews with researchers and experts alike. The report, which is synthesised here, provides an overview of the programme from 2003 to 2011.

The objective of the review was to step back and critically reflect on the activities conducted within the framework of the livestock systems research programme, as well as on their impact in a broader sense.

A total of twelve projects were analysed in detail: six from the first phase (2003–2007) and six from the second phase (2006–2011). The evaluation distinguished three different levels for which various indicators were defined (see box on page 53): (i) research outputs at the project level, (ii) outcome related to dissemination/adoption or uptake/adaptation, and (iii) awareness and impact such as early benefits.

The research *output* of the programme was evaluated based on the results and on the capacity building efforts of the different projects. As a first step, we evaluated the extent to which the targets were achieved by comparing the research results achieved with the results as intended at the project start. Furthermore, the research output was measured by the amount of publications written. Capacity building efforts were evaluated in two ways: by calculating the number of trained BSc, MSc and doctoral students and by analysing the career development of the doctoral students involved in the projects. The *outcome* of the research projects was also analysed on different levels. Communication activities and collaboration with non-scientific partners were critically reflected. The leading question of this section was whether and how the research results were disseminated to the beneficiaries – in most cases to farmers and their families. Stakeholder workshops, production of information material or media coverage were, among others, possible indicators considered. A second element of the outcome analysis dealt with the question of how the results matched with research on livestock systems in a wider context. The last step of the analysis, namely *awareness and impact*, concentrated on actually or potentially intended changes on the stakeholder level (mainly policy-makers or farmers). We assessed whether these changes

were a direct consequence of the programme. In this context, the relevance of the programme and its congruency with the SDC strategy were investigated.

Valuable output and outcome despite difficult and changing framework conditions

The project representatives reported mostly scientific results. Besides this strong focus on scientific results which subsequently led to good publication records, some projects also aimed at developing capacities and ensuring knowledge and know-how transfer. Furthermore, the programme requested that the projects will generate results, which directly lead to policy or management recommendations.

All projects produced important results, both in terms of publications and capacity building (outputs) and in terms of generating outcome that could be used to improve the livelihoods of the beneficiaries. In autumn 2011, we counted a total of 112 different publication records directly linked to one of the twelve livestock system research projects. Of these records, 28 were refereed publications listed in the web of science and four were book chapters. Some 80 students were trained in the course of the twelve different research projects. In total, 29 students earned their doctorate, eight originating from developing countries. Various communication activities conducted in collaboration with different research institutions and extension offices have facilitated the dissemination of results. The North-South Centre played a vital role in communicating livestock-related research of ETH scientists. It organised different forums and published an annual report informing on research, capacity building and communication activities including the ones carried out in the context of the livestock systems research programme.

Despite the satisfying publication records at the project level and high quality communication efforts by the North-South Centre, the research programme has not caught

	Analysis level	Field	Indicator
Output	Research outputs at the project level	A: Results	Intended vs. actual results (incl. capacity development)
		B: Publications	Number and ranking of publications
		C: Capacity building (i)	Number of BSc, MSc and doctoral theses
		D: Capacity building (ii)	Career development of project participants (doctoral students)
Outcome	Dissemination and adoption	Communication activities or collaboration with partners outside science	Stakeholder workshops organised Information material Media coverage
	Uptake and adaptation	Policy or management recommendations	Findings discussed in a broader context Policy and/or management recommendations formulated
Awareness and impact	Early benefits	A: Stakeholder actions	Changes in practices or management (actual and intended respectively feasible)
		B: Relevance	Assessment of relevance of programme by expert
		C: Congruency with SDC strategy	Assessment of programmes' congruency with SDC strategy
	Awareness	Internal congruency and integration	Coherence and interaction between projects

Framework of categories and indicators used for the review

much attention at SDC, the donor agency. It is a given that livestock is important for development through its capacity to provide food and income. It is also accepted that it is important to gain further insight into the complex interdependencies between these positive aspects and the diverse negative externalities linked to animal-source food production.

Nevertheless, the programme did not manage to get livestock back on the SDC agenda. For different reasons: First, the ambivalent nature of livestock production, its benefits and shortcomings, apparently make it difficult to integrate livestock in a development programme. Second, since 2003, several external factors impeded the efforts of the North-South Centre to reinforce the relevance and importance of livestock research. These factors include the reorganisation at SDC and the failure in appointing a professorship in animal sciences with specific interest in North-South matters at the ETH Zurich.

Highlights at the project level

Most of the highlights mentioned by the project representatives were of scientific nature, for example interesting results published in high-ranked journals. We assessed these research results linked to the objectives of the research projects. However, many additional highlights were not anticipated when the projects were formulated. Management issues such as motivated and excellent students and co-workers or successful project management are necessary preconditions for extraordinary achievements. Other important highlights were the experiences made while collaborating with farmers. Lastly, scientists and students experienced educational highlights related to achievements in capacity building in the South, mainly student training.

Such unplanned project highlights are very well known to all researchers involved in research for development. They are the fuel to continue research where it matters, even if framework conditions or funding structures are changing.

Impacts of water management on arsenic uptake by rice in Bangladesh

Groundwater irrigation of dry season rice (*boro*) has greatly improved food security in Bangladesh. However, due to high concentrations of arsenic (As) in many groundwater resources used, irrigation is leading to increased As levels in paddy soils and rice. In the long-term, irrigation may also compromise rice yields. Owing to the gradual accumulation of As in paddy soil, the adverse effects of groundwater irrigation also extend to monsoon rice (*aman*) cropped under rain-fed or river-flooded conditions. Arsenic is strongly redox-sensitive and predominantly mobilised into soil porewater when soils are flooded and reducing conditions prevail. Irrigation management during the dry season and the water regime during the monsoon may thus significantly influence As uptake by *boro* and *aman*, respectively.

This research project compared As uptake by *aman* under intermittently and continuously flooded conditions. The field work was conducted in Jessore district in western Bangladesh, in an area where *aman* has been cropped in rotation with groundwater-irrigated *boro* for the past 15 years. We selected two fields in which flooding due to rainfall is generally intermittent. Using supplementary irrigation – required for both fields as rainfall was exceptionally scarce – we maintained one field continuously flooded, while the second field

was flooded intermittently. The flooding regime was controlled by using As-free pond water for two subplots within each field, while groundwater containing $160 \mu\text{g L}^{-1}$ As was used for the remainder of the fields.

The study results showed that As concentrations in the soil above the plough pan – the main rooting zone of rice plants – were significantly lower under intermittent than under continuous flooding. Consistent with this, As contents in straw and grain were on average 3.0, respectively 2.5 times lower in the intermittently flooded field than under continuous flooding. By contrast, the source of the water used for irrigation did not affect As content in grain and straw significantly. These findings substantiate previous evidence: The water regime of As-contaminated paddy soils influences plant uptake more strongly than the As added by irrigation during a particular growing season.

The areas in which *aman* and *boro* can be cropped in rotation have the highest crop production potential in Bangladesh. Within these areas, As input to soil should be reduced with priority in shallowly flooded locations, where *aman* production is most severely affected by soil As contamination.

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Post-doc fellow

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Supervisors

Stephan Hug, Andreas Voegelin and Janet Hering, Eawag, Switzerland

Collaborators

M.A. Ali and A.B.M. Badruzzaman, Bangladesh University of Engineering and Technology; M.A. Hamid Miah, IRRI, Bangladesh; M.R. Islam, Bangladesh Agricultural University

Duration

May 2010 – December 2011



Preparing for sample measurements in the field in Jessore, Bangladesh

The merits of a leader-based punishment institution in the provision of public goods

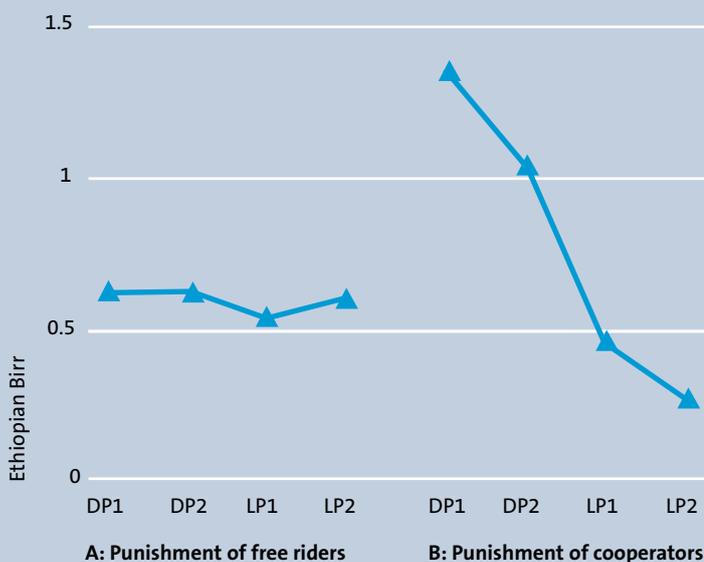
The successful provision of public goods depends on solving cooperation dilemmas. Diffuse punishment (DP) in which players have the option to punish each other is one way to achieve this. However, DP generates second order dilemmas and has a cooperation-enhancing effect only when punishments are targeted at free riders. Laboratory studies show that anti-social punishment of cooperators is as common in DP as the punishment of free riders, leading to underprovision of public goods. In such situations, groups perform better in the absence rather than the presence of punishment opportunities.

In this study, we test the scope of a leader-based punishment institution in reducing the extent of anti-social punishments while maintaining the provision of public goods. The study was conducted with actual members and leaders of villages engaged in forest commons management in Ethiopia. We implemented a “within-subject design” in which 84 members from seven villages took part in two punishment institutions: DP and leader-based punishment (LP). In each punishment institution, members have to pay to punish. The punishment ratio is 1:3. This means that if a member decides to punish, he or she loses one Birr and the punished player loses three Birr. Thus, punishment is more costly for the punished. The key difference is that while in

DP each player could punish another player from his group, in LP the players could only indicate their punishment decision at an identical cost, but the punishment authority rests with the actual leader who is not obliged to punish. Both institutions were implemented using an anonymous, two-period public goods game.

We find that while the provision of public goods is unaffected, punishments decline significantly in LP. We examine whether the drop in punishment is due to a drop in free rider or a drop in anti-social punishment. The results show that while there is no change in free rider punishments, both the likelihood and the severity of anti-social punishments decline significantly in LP. Further analysis shows that punishments decline in LP mainly because of change in the punishment behaviour of individuals who punish both free riders and cooperators in DP. While these individuals reduce the level of their anti-social punishment in response to LP (part B of the illustration), the level of their free rider punishment remains unchanged (part A).

These results show that while LP is at least as effective as DP in the provision of public goods, it is much more efficient. This is because the loss in earnings due to anti-social punishments is much lower in LP than in DP.



Punishment behaviour of anti-social players in diffuse punishment (DP) and leader-based punishment (LP)

Post-doc fellow

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Collaborators

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Duration

July 2010– December 2011

Exploring the effects of anti-tick vaccines on the transmission of *Theileria parva*

In this project we evaluated two anti-tick vaccines (ATV) for their ability to interfere with the transmission of *Theileria parva*, the causative agent of East Coast Fever in cattle, by the tick vector *Rhipicephalus appendiculatus*. In an attempt to decrease the over-whelming burden of tick-borne diseases (TBD) faced by both large scale and subsistence farmers, tick vaccines have been proposed as a method to control various TBDs.

The first trial evaluated the effect of recombinant *R. appendiculatus* Ra86 based vaccination for its ability to block both the uptake of parasites by ticks feeding on *T. parva* infected cattle as well as the reproductive capacity of the tick vector. Compared to previous reports, Ra86 vaccination showed an increased effect as vaccination drastically decreased the moulting of nymphal ticks to the adult stage – a previously unreported effect. The effect of whole herd vaccination over time was simulated by combining the tick biological parameters used to evaluate the effect of vaccination. Herd vaccination with Ra86 was simulated and was shown to reduce tick populations by pushing them to negative growth rates. With this, we emphasised the potential of Ra86 vaccination as a sustainable tick control strategy.

The second trial evaluated a multivalent vaccine, which targeted the tick vector and the transmitted *T. parva* parasite in an attempt to develop a transmission-blocking vaccine for East Coast Fever (ECF). The vaccine was composed of a cocktail of antigens including the *T. parva* derived p67 and the tick derived antigens TRP64, histamine binding protein and subolesin. The vaccine was evaluated by the use of a tick strain, which was specifically designed to simulate field conditions in terms of *T. parva* infection levels. The vaccine lowered the incidents of ECF with 75% of vaccinated animals contracting the disease – compared to 90% in the control group. Interestingly, all animals exposed to the *T. parva* tick challenge developed solid ECF immunity. They withstood a subsequent lethal needle challenge with the homologous *T. parva* strain without signs or symptoms of ECF. Currently, experiments are underway with the goal to elucidate the cellular basis of these remarkably effective immune responses induced by the transmission of *T. parva* sporozoites. The results from the two ATV trails show, for the first time, the potential great impact of anti-tick vaccination for ECF control. Further research is warranted to harness this new knowledge for improved ECF control strategies.

Research fellow

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Supervisors

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Richard Bishop, ILRI, Kenya

Collaborators

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Onderstepoort Veterinary Institute, South Africa

Duration

May 2008–June 2012



Syncerus caffer (the African Buffalo) is the natural reservoir of *T. parva*

Understanding the views of the rural poor in two territories in Honduras

In Honduras, about half of the population live and work in rural areas dominated by steep hills and mountains. Their economic activities are based on agriculture, predominantly small-scale or subsistence farming. Access to services and economic opportunities other than agriculture is low and the poverty rate is very high. In 2001, Honduras introduced an ambitious Poverty Reduction Strategy (PRS) in order to fight poverty and to receive debt relief. The strategy included measures such as a general increase in social expenditure, the set-up of a decentralised poverty reduction fund, or specific programmes aiming at improving the agricultural production and reactivating the rural economy. Eight years later, after the coup d'état, the PRS was substituted by a national development plan.

This project aims at analysing the PRS experience in two municipalities in western Honduras by exploring the livelihoods of the rural poor and the PRS processes and projects carried out locally. The project is focusing on the implementation of the decentralised poverty reduction fund and its benefits for poor and marginalised households in view of future development strategies.

Based on a household survey as well as a landscape and history mapping carried out in 2009, two contrasting villages had been selected in each case study municipality. Together with a local assistant, we conducted in-depth interviews with more than 70 poor and extremely poor households. The goal was to investigate their livelihood practices, the challenges they face, the benefit they gain from PRS projects, and their participation in the PRS process.

Although they do not tackle all aspects which cause poverty, the analysis revealed that local PRS projects largely fit with the needs of the studied households. However, a lot of the households have difficulties in accessing these PRS projects. Most of the decentralised projects require that the people are organised. Poor peasants in the studied municipalities are not likely to be organised – a fact also recognised in the literature. In addition, these PRS projects often involve economic contributions from the participants. This is further excluding poor households. Finally, who is asked to participate in a group is based on social ties. Poor households, especially female headed households often lack the necessary social ties. Hence, although the local PRS projects fit with the needs of poor households, several mechanisms are leading to their exclusion.



Trading at the local market is one of several income-earning strategies of poor peasant households.

Research fellow

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Supervisors

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Collaborators

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Duration

June 2008 – May 2012

Governance, collective action and development interventions in vegetable value chains

Vegetables are considered to be high-value agricultural products. These products have relatively high unit prices, a high income elasticity of demand and their production requires a considerable amount of labour. Due to rapid urbanisation in developing countries and globally changing consumption patterns, the demand for vegetables is expected to rise substantially. As a result, the sector has received significant attention from the donor community with the focus on how to integrate smallholders into these emerging and potentially profitable value chains.

This project analyses the potential for African smallholder producers to benefit from these developments. Specifically, the project addresses three areas: (i) the governance modes of vegetable value chains, (ii) the aspects of collective organisation for marketing the produce, and (iii) the interventions of external facilitators in vegetable value chains.

Northern Tanzania was chosen as the study region because it is a major vegetable growing area. It has a favourable climate and abundant water resources and the vegetable production is not only of domestic but also of regional relevance. Furthermore, there exists a small but growing industry of high-value vegetables for export to developed countries.

As a first step, we developed a typology of existing vegetable value chains, thereby identifying the following value chain types: Green markets, processed vegetables, vegetable seed production, institutional procurement, catering and tourism industry, as well as fresh vegetable export to developed countries.

During the fieldwork, we mapped these value chain types and developed and conducted stakeholder-specific, quantitative surveys at retail, wholesale, transportation and producer level. These surveys were complemented with a qualitative survey on interventions of development agencies.

In terms of volume and value, the local and urban green markets are clearly the dominating value chains of the sector. The other value chains can be considered niche markets – with a considerable growth potential though. With regard to governance modes, we found a continuum from the green markets to the fresh vegetable exports with increasing product quality requirements but a decreasing risk of price fluctuations. Smallholder integration is reported for all value chains. However the long-term viability of this integration is facing multiple challenges.

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Research fellow

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Collaborators

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Andrew Temu, Sokoine University of Agriculture, Tanzania

Duration

August 2008 – July 2012



Farmers setting stakes for tomatoes, Northern Tanzania

The importance of forest fragments in local livelihood systems

At our study site on the east coast of Madagascar, most contiguous forests have already been cleared or separated, resulting in forest fragments which are embedded in mosaic landscapes. Forest fragments provide substantial products and environmental services for the livelihoods of the local population. They are threatened, however, by deforestation due to slash-and-burn agriculture.

The aim of this research project was to gain an improved understanding of the role that forest fragments play in the daily life of rural households. This allowed us to identify the driving forces of deforestation and possible ways to improve forest management within the given livelihood systems.

We found that the importance of forest fragments with regard to local livelihood systems is, above all, related to their significance as soil reserve. This function of a soil reserve is not only fundamental in terms of agricultural production, but also with regard to cultural beliefs and personal attachments of local farmers. Forest products are gathered as long as they are available. However, as soon as arable and fertile land is required, agricultural production becomes more important than forest resources. In addition, local

farmers judge the importance of forest fragments depending on the context of the family. Access to as well as availability of forest resources and the individual wealth of a family are influencing this judgment to a large extent.

As the results should be useful and directly applicable in the Manompana corridor, we adapted the investigation and discussion of our data according to the local community-based forest management (CBFM) project. We found that the population of the Manompana corridor is not yet prepared for CBFM. Furthermore, the context in which farmers are living is not appropriate for implementing CBFM. At the moment, local livelihood systems are not compatible with a sustainable forest management. It would be essential to fundamentally improve the local, regional and national context in which farmers are operating. In addition, a thorough modification of cultural attitudes should also be envisaged. Thus, combining the conservation of remaining forests with the local livelihood systems and with poverty alleviation is a highly challenging goal requiring a long-term process. For its realisation, different stakeholders have to contribute: The state government, multilateral donors, researchers as well as the local population.



Wild honey is one of the forest products gathered by farmers in Madagascar.

Research fellows

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Supervisors

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Collaborators

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Etienne Andriamapandry,
Association Intercooperation, Madagascar

Duration

September 2008 – December 2011

Ethanol production impacts on land use and deforestation

Although they currently constitute only a small proportion of global energy supply, biofuels production has grown rapidly in the last few decades and is expected to continue doing so. Despite the initial enthusiasm concerning biofuels environmental benefits, a fierce debate has begun in the last decade, testifying for raising concerns regarding their production. The debate focuses mainly on two possible impacts of biofuels production: on food commodity prices on the one hand, and on land use decisions on the other hand. However, the links – either direct or indirect – between bioethanol production, land use and forest conversion are still not well-understood, neither at the conceptual nor at the empirical level.

This project aimed at investigating biofuels impacts related to local inputs demand, especially land. Indeed, since land is an essential input of biofuels production, the latter compete for the former with other possible land uses including forests. The project results contribute to clarifying the ongoing debate on biofuels desirability. First, they give theoretical grounds to the view that biofuels expansion may result in indirect land use changes by providing incentives to clear forests. Second, using Brazil as a case study,

we made a first step aiming at accurately estimating the potential size of these indirect land use changes. In particular, our results provided evidence of a displacement effect, originating from the expansion of sugarcane. Sugarcane is the energy crop used to produce the Brazilian ethanol. In fact, in the last three decades the expansion of sugarcane acreage in the Central-Southern region of the country induced the displacement of ranching activities toward the Amazon forest frontier, located further north.

If biofuel-producing countries decide to continue ethanol production, new environmental policies will be needed. It is important to ensure that displaced activities are directed towards unoccupied land and not towards forest frontiers. Additionally, since indirect displacements may take a certain number of years to materialise, impact assessments of policies favouring biofuels production should be monitored over a long period of time.

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Research fellow

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Supervisors

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Collaborators

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Sven Wunder, CIFOR, Brazil;
Paulo Moutinho, Amazon Center for Environmental Research, Brazil;
Lucimar Abreu, Embrapa ambiente, Brazil

Duration

February 2009 – October 2011



Sugarcane fields, São Paulo State, Brazil

Phosphate nutrition of crops in lixisols from semi-arid West Africa

A very large proportion of the population living in the semiarid areas of sub-Saharan Africa lives from subsistence agriculture and is suffering from extreme poverty and food insecurity. Research conducted in West Africa has shown that organic matter and phosphorus (P) inputs are essential to restore the fertility of the fragile soils (lixisols) and to improve crop production in the region. However, there is a lack of information on how organic amendments affect P availability to crops in these lixisols.

This project conducted in the centre of Burkina Faso aims at evaluating the effects of organic amendments on soil P dynamics, on crop nitrogen (N) and P nutrition, as well as on crop productivity. The model crops used are sorghum (*Sorghum bicolor*), which is widely cultivated in the area, and promiscuous cowpea (*Vigna unguiculata*), which is an important cash crop. The project is based on the following experiments: (i) an on-farm study to understand the variability of crop yields under various soil fertility management practices; (ii) a field trial to investigate the long-term effect of various rates of organic and mineral inputs on the symbiotic N₂ fixation by cowpea, on soil nutrients availability, on crop nutrient uptake with emphasis on P, and on crop yields; (iii) a laboratory soil incubation experiment to study microbial P limitation under various fertilisation regimes, combining soil respiration and microbial P measurements.

Preliminary results of the data analysis show that in the farmers' fields, there is a large variability in crop yields and in soil chemical properties. About 25% of the variability in sorghum yields is explained by the fertilisation practices. Some 11% is explained by field management practices such as sowing density, type of soil preparation, distance between field and household, and techniques applied to avoid soil erosion. Soil chemical properties explain only 9% of the variability in sorghum yields. In addition, we found that the variability in cowpea yields – grown in monoculture – is not explained by the fertilisation practices but by the field management and soil chemical properties at 26% and 30% respectively.

The results of the N₂ fixation experiment are not yet completed. However, the results of a test analysis show that cowpea could fix in average about 20 kg ha⁻¹ of N. The incubation experiment shows that microbes in the lixisols are P-limited, a finding that needs to be confirmed by further experiments.



Measurement of cowpea yield in farmers' fields, Burkina Faso

Research fellow

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Supervisors

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INERA, Burkina Faso

Collaborators

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Michel Dumondel and Martijn Sonneveld, ETH Zurich,
Switzerland

Duration

May 2009 – May 2012

Characterisation of drought tolerance in cassava

Breeding drought-tolerant crops is an option to mitigate the threats posed by droughts that significantly constrain world agriculture. The application of advanced technologies could substantially increase the efficiency and success of breeding programmes. In turn, the improved cultivars could contribute to food and income security and to the development of a sustainable agriculture in a potentially adverse environment.

This project focuses on drought tolerance in cassava, a staple crop for nearly one billion people in more than hundred countries. Cassava yields more than most crops on low fertility soils and in areas of uncertain rainfall patterns, which often lead to prolonged drought periods. Cassava exhibits various traits that are directly linked to its ability to sustain yield under drought conditions. The staygreen phenotype has been suggested as a possible means to increase cassava productivity in such conditions. Cassava cultivars with the staygreen trait have been found to produce more total fresh biomass and higher root dry matter than cultivars without that trait.

The use of molecular tools and the analysis of improved drought tolerant crop lines, which are already available, have permitted developing molecular markers that are generated from gene sequence data. These markers are completely

linked to the trait of interest and they allow selection in different genetic backgrounds without revalidating the marker QTL¹ allele relationship.

In this project, we generated a list of the drought-related genes from other crops and blasted their sequences onto the cassava genome database at www.phytozome.net in order to confirm orthologs in cassava. In addition, we developed specific primers designed from the orthologs for relative gene expression analysis through qRT-PCR² in several cassava genotypes. Four cassava genotypes contrasting for drought tolerance have been selected based on data obtained from field drought trials. We are currently evaluating these genotypes under induced water-deficit stress in the greenhouse. Fibrous roots and leaves will be sampled, RNA³ extracted and cDNA⁴ synthesized. Thirty-five primers have been designed and will be used in qRT-PCR on the cDNA. The sampled materials will be used for differential gene expression studies and, thus, for the development of molecular markers for marker-assisted selection of drought tolerance in cassava.

¹ quantitative trait locus

² quantitative Reverse Transcription Polymerase Chain Reaction

³ ribonucleic acid

⁴ complementary deoxyribonucleic acid

Research fellow

Charles Orek, ETH Zurich, Switzerland

Supervisors

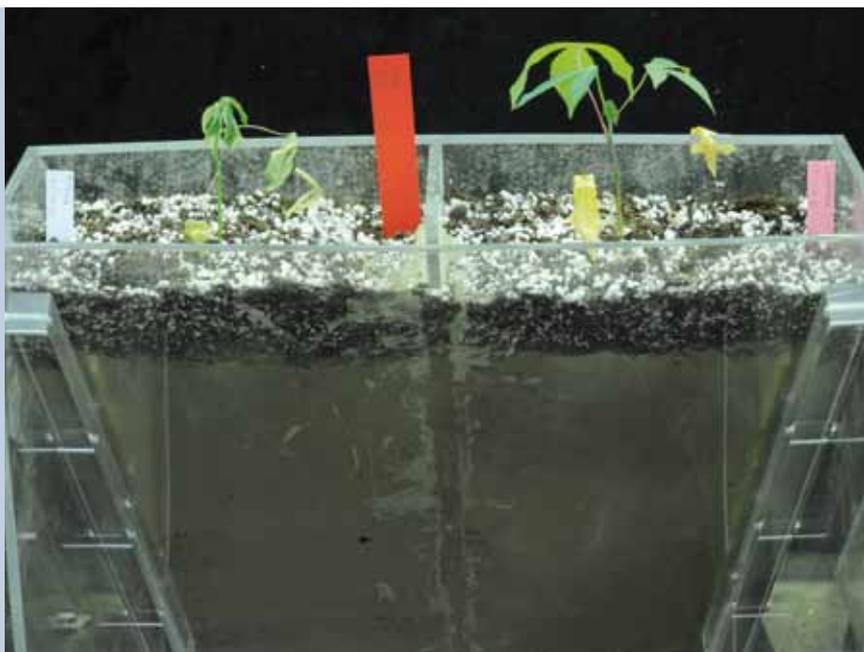
Wilhelm Gruissem and Hervé Vanderschuren, ETH Zurich, Switzerland;
Morag Ferguson, IITA, Kenya

Collaborator

Joseph Kamau, Kenya Agricultural Research Institute

Duration

July 2009 – July 2012



Variations in leaf retention under water deficit conditions in the greenhouse

Whole genome profiling of *Theileria parva* isolates

Theileria parva is a protozoan parasite that causes East Coast Fever (ECF), a fatal lympho-proliferative disease inflicting cattle in East, Central and Southern Africa. It causes an economic loss of at least US \$168 million annually. The infection and treatment method (ITM) of vaccination confers some protection resulting in a carrier state. ITM is composed predominantly of three strains of *T. parva* – Muguga, Serengeti and Kiambu 5 – the combination of which is believed to protect across strains. However, the mechanism by which this is achieved is unknown.

In 2004, the genome of the Muguga strain was sequenced by the Sanger method. In this project we used the Roche 454 method to sequence the genome of Serengeti, along with four strains from different geographical regions: Katete (Zambia), Marikebuni (coastal Kenya), Muguga2 (Kenya), and Uganda. In addition, recombinants of Muguga/Marikebuni and Muguga/Uganda were sequenced. We also successfully isolated piroplasms for Kiambu 5, which in the past have proved challenging to acquire.

In order to obtain a high-resolution genome-wide map of genotyping markers that can be used for determining the diversity of the parasite, we developed a custom-made analysis pipeline. 115 005 single nucleotide polymorphisms (SNPs) were identified in the eight strains. Exons accounted for >65% of the SNPs while 14–17% were found in introns

and 18–19% in intergenic regions. This is in accordance with the finding that the genome of *T. parva* is composed of 68.4% coding sequence. The SNPs identified in our study increased the marker resolution for *T. parva* by 800 times compared to previously published data.

Protection to *T. parva* is mediated by MHC class I-restricted CD8+ cytotoxic T lymphocytes, which in *T. parva* have been shown to recombine in the tick host. Such recombination events could facilitate an immune evasion of the parasite within the tick and cattle host. The SNP profiles of the recombinant strains and their parents were used to determine recombination breakpoints in the parasite. We identified 15 and 24 crossovers as well as 52 and 56 gene conversions in the two recombinant strains. Our findings have significantly enhanced the understanding of the extent of recombination in *T. parva*.

In addition, Ka/Ks analysis was carried out on full-length predicted genes with homologues in all strains. We identified 81 genes potentially under positive selection. These genes might be involved in host parasite interactions and they are prime candidates to be studied in more detail in the future.



A Friesian cow being tested for *T. parva* Kiambu 5 infection at ILRI, Kenya

Research fellow

Sonal Patel, ILRI, Kenya

Supervisors

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Richard Bishop, ILRI, Kenya

Collaborator

Weihong Qi, University of Zurich, Switzerland

Duration

August 2009 – January 2012

Healthy rice for healthy people: Biofortification of zinc in rice

Zinc (Zn) deficiency is a widespread micronutrient disorder in humans and plants. The severity of soil Zn deficiency is further enhanced under the flooded conditions that are typical of rice production. Rice, being a poor source of Zn, leads to Zn deficiency-induced malnutrition in humans who are dependent on rice as a staple diet. Understanding and identifying the physiological mechanisms controlling Zn uptake and transport into rice grains is crucial in terms of increasing both the productivity and nutritive value of the crop. This project aimed at understanding the physiological mechanisms influencing Zn deficiency tolerance, Zn uptake, and internal Zn transport in a range of rice genotypes.

Results from greenhouse experiments carried out at the International Rice Research Institute indicated that direct root uptake of Zn during grain filling stage is the predominant pathway of Zn accumulation in rice grains under Zn-sufficient condition. Under Zn-deficient condition, rice genotypes showed significant variation in their pathway of grain Zn accumulation. We carried out ⁶⁵Zn labeling experiments at the ETH Zurich to track the actual movement of Zn from either root or leaves to grains. Two contrasting high grain Zn lines were studied: IR69428 and SWHOO. The results suggested that IR69428 had more active roots than SWHOO at grain filling stage. Furthermore, we carried out

field experiments in Zn-deficient peat soils. We tested whether a genotype capable of developing more nodal roots can take up more Zn from oxidised surface layers of flooded rice fields than genotypes developing less nodal roots. Under Zn-deficient conditions, Zn-efficient genotypes developed significantly more nodal roots than Zn-inefficient genotypes.

In the second part of the project, soils collected from different parts of the Philippines were continuously stirred and saturated with nitrogen. This microcosm was set up to identify the factors affecting the plant availability of Zn as the soil redox potential decreased after flooding. All four soils showed a fast decrease in available Zn upon reduction. Two of the soils maintained a low available Zn plateau level over time. The third soil continued to show decreasing available Zn throughout the four-week experiment. The fourth soil began to supply more DTPA¹-extractable Zn over time. The specific redox potential at which the available Zn fell below the critical level of 1 mg/kg varied widely between soils. Geochemical modelling suggested the formation of insoluble Zn compounds as the main cause for decreased plant uptake of Zn in flooded soils.

¹ diethylene triamine pentaacetic acid

Research fellow

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Collaborators

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Switzerland

Duration

August 2009 – August 2011



Zn-deficient lowland rice field at IRRI, Philippines

Farmers' responses to climate change in northern and central areas of Côte d'Ivoire

As most developing countries in Africa, Côte d'Ivoire has experienced an increase in climatic variability since the late 1960s. A reduction of up to 28% in rainfall and an increase in temperature has severely affected both food crops and livestock. Therefore, this project aims at analysing farmers' decision-making processes related to climate change and their risk management strategies when faced with its negative impacts. Furthermore, we will investigate farmers' perception of climate change and their adaptation behaviour taking into account the institutional context in Côte d'Ivoire. Data will be obtained through qualitative interviews, focus groups and surveys. On the basis of the results, we will elaborate feasible and acceptable adaptation strategies to climate change and make suggestions on how to transfer this knowledge to the stakeholders.

In 2011, we conducted 16 focus groups in the northern and central country to assess all threats to farm management – including the threats related to climate change. Moreover, we have analysed the farmers' perception of climate change and all endogenous strategies implemented to deal with the identified threats. The findings allow us to figure out the decision field of the farmers related to their farm management. We have identified all internal and external

factors, which influence the farmers' behaviour in their decision-making in adapting to climate change, as well as the interrelationships between them. We concluded that the farmers' awareness of climate change is already high in both study areas. In addition to the perception of changes in weather conditions, the farmers perceive climate change through changes linked to their farming practices. Furthermore, the adaptation levels in both study areas appear rather similar. The strategies "change in methods of planting", "adjustment of agricultural calendar", "change of crop varieties" and "mixed crops" are the most developed strategies to adapt to climate change.

As a next step, we will carry out a survey based on the results of the focus groups. The survey will allow us to quantify the factors influencing the farmers' decision behaviour. Complementing the doctoral research, a Master student will focus predominantly on the institutional context of the farmers by using a network analysis. He will analyse the important units, the interdependencies within these units as well as the weaknesses and strengths of the social network surrounding the farmers. The results of the Master thesis will allow the successful implementation of the recommendations resulting from the doctoral study.



A farmer showing a new variety of weed in the village of N'dakouassikro Toumodi, Côte d'Ivoire

Research fellow

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Supervisors

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Collaborators

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Marcel Tanner, Swiss TPH, Switzerland

Duration

October 2009 – January 2013

Reducing the impact of cassava brown streak disease

Cassava serves as staple food for nearly a billion people in 105 countries of the tropics and sub-tropics, where it provides as much as one-third of the daily calories. Particularly in Africa, the root is regarded as food insurance of the poor, since it produces stable yields even in the face of prolonged drought conditions, low soil fertility and low labour input. Cassava is vulnerable to at least 20 different viral diseases. More recently, cassava brown streak disease (CBSD) has caused devastating losses in cassava fields in East Africa. CBSD is endemic to Africa and caused by the cassava brown streak virus (CBSV) and the Ugandan cassava brown streak virus (UCBSV). Our project aims at contributing to the protection of cassava from the devastating effects of viral diseases.

We evaluated the natural resistance/tolerance in the existing elite cultivars as well as in the material bred for CBSD resistance by Tanzanian and Kenyan breeders. This initial virus resistance evaluation – against both CBSV and UCBSV isolates – allowed us to identify symptomless cassava accessions upon grafting on CBSD infected rootstocks. At the Natural Resources Institute (NRI) of the University of Greenwich, the best performing accessions are currently being assessed for resistance against additional CBSV

isolates collected in Tanzania, Kenya and Uganda, as well as against mixed infections (CBSV and UCBSV). Initial results indicate that at least one accession has a stable resistance against all CBSV and UCBSV isolates as well as against mixed infection. Transcriptional response to CBSV infection in the accession with stable resistance is being characterised using next generation sequencing technology. Correlation analysis between expression patterns of the candidate genes and natural host resistance will be used to determine novel molecular markers to breed for CBSD resistance in cassava.

Furthermore, disease-free material from the best performing cultivars and from susceptible control accessions has been transferred to IITA in Tanzania for a field test. This evaluation of CBSD resistance, combined with the results from the assessments conducted at NRI, will give further indication about the stability of the CBSD resistance.

Transcriptome profiling of the best performing accession when exposed to virus infection is being performed at the Functional Genomics Center Zurich. A detailed analysis of the transcriptome sequencing data will allow us to identify markers, which are associated with resistance.

Research fellow

Ravi Bodampalli Anjanappa, ETH Zurich, Switzerland

Supervisors

Wilhelm Gruissem and Hervé Vanderschuren, ETH Zurich, Switzerland

Collaborators

Maruthi M.N. Gowda, University of Greenwich, UK; Edward Kanju, IITA, Tanzania

Duration

April 2010 – April 2013



Evaluating CBSV resistance by grafting symptomless cassava accessions onto CBSD-infected rootstocks

Enhancing tree growth by exploiting beneficial insects and defensive plant traits

The establishment of native timber trees on deforested land such as cattle pastures in Central and South America could contribute to the livelihood of small-scale farmers and to the protection of remaining forests. Supplementary tree planting on pastures may provide small-scale farmers with additional income by increasing milk and meat production through the provision of fodder and shade for cattle. Tree planting can also improve the soil structure and support the local biodiversity. However, tree-damaging insect pests often impede successful timber tree establishment and growth. The design of environmentally-friendly pest management strategies is hence imperative for the implementation of sustainable agroforestry and, as such, a relevant development goal.

Along these lines, this project aims at investigating environmentally-friendly pest management strategies: top-down control of insect pests through the impact of beneficial insects and bottom-up through the impact of defensive plant traits. Both strategies aim at enhancing tree growth owing to favourable planting systems. Beneficial insects may comprise ants or parasitoid wasps. Defensive traits are chemical or physical plant properties that reduce the survival and performance of pest species (antibiosis) or make the plant less attractive to them (antixenosis).

Two innovative planting systems have been established in an experimental plantation in Central Panama: a pasture-afforestation system and a silvopastoral system. In the pasture-afforestation system, the native timber tree species *Tabebuia rosea* (Bignoniaceae) is planted in high-density in a classical monoculture and in a three-species mixture. The silvopastoral system, with low density planting, is considered a promising option to cultivate valuable timber trees within existing pastures while at the same time maintaining livestock.

Arthropod communities were sampled to assess the effects of environment and tree characteristics on pest herbivores and their antagonists on *T. rosea*. We conducted experiments in order to assess the relative importance of plant defences and arthropod antagonists on the distribution and impact of herbivores. Results are expected to identify useful natural resources, which limit damage to native timber trees by destructive insect herbivores in innovative planting regimes in Central America.



Locals examining beneficial ant species attracted to baits on native timber trees, Central Panama

Research fellow

Judith Riedel, ETH Zurich, Switzerland

Supervisors

Silvia Dorn and Karsten Mody, ETH Zurich, Switzerland

Collaborators

Catherine Potvin and Hector Barrios, Smithsonian Tropical Research Institute, Panama

Duration

April 2010 – April 2013

Ancient genes for future rice

More than half of the world's population depends on rice as their main staple food. Most of the rice farmers and consumers live in Asia and Africa with a large proportion of urban and rural poor. Considering the growing population and climatic changes which increasingly threaten rice production, it is critically important to develop new rice varieties that maintain high yield and good grain quality under adverse conditions, most importantly under drought stress and flooding. Drought stress is recognised as one of the most significant environmental stresses in global agriculture and is closely linked with problem soils, especially phosphorus (P) deficient soil. Thus, securing yield under multiple stress environments stands as a major challenge for crop breeding.

Our strategy for developing stress-tolerant cultivars is to uncover the underlying genetic components from unadapted rice varieties that have poor agronomic performance but stronger tolerance mechanisms. Recently, *aus*-type varieties have been reported as good donors, especially for abiotic stress tolerance. According to preliminary field data, the two *aus*-type varieties Dular and Kasalath show good performance under drought stress and P-deficient conditions. The data indicates the potential of these varieties for use as a tolerant donor for the trait.

In this project, we are using Next-generation sequencing to identify novel tolerance genes that are specifically expressed in roots of Dular and Kasalath when grown under drought stress and P-deficiency conditions. In the early phase of this project we conducted a greenhouse experiment in which rice plants were subjected to a combined drought stress and P-deficiency. As a control treatment, rice plants were raised under normal irrigation and fertilisation regimes. To create P-deficiency stress, minimal amount of P fertiliser was applied. To create drought stress, watering was stopped within the vegetative stage and the water level in the soil was monitored daily. At different sampling points within the experiment, shoots and roots total RNA¹ were extracted separately. The comparative analyses of the root transcriptome of these tolerant *aus*-type varieties are expected to yield in the discovery of novel genes and allelic variants of known genes. The findings of this project could potentially lead to the development of gene-based markers for the most valuable gene(s), which can then facilitate the development of tolerant breeding lines.

¹ ribonucleic acid

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Research fellow

Jonghwa Park, ETH Zurich, Switzerland

Supervisors

Wilhelm Gruissem and Navreet Kaur Bhullar,
ETH Zurich, Switzerland

Collaborator

Sigrid Heuer, IRRI, Philippines

Duration

February 2011 – January 2014



Rainfed lowland area mostly consists of problem soil and heterogeneous environment. Soil used in our experiments was obtained from such an area in the Pangil province, Philippines.

Forest dwellers and biodiversity in the context of industrial forestry

In the Congo Basin, the second largest block of tropical rain-forest worldwide, wildlife management presents a major challenge to responsible logging companies operating in that region. Wildlife is a key focus of many western conservation efforts and it plays a central role in the forest dwellers' livelihoods. The objective of this research project is to contribute to the development of collaborative wildlife management strategies that are beneficial to conservation goals and, at the same time, consider the interests of logging companies and most importantly forest dwellers.

In our research, we have adopted a policy-science approach to analyse the complex social dynamics underlying the problem. In order to assure that the interests of forest dwelling communities are sufficiently taken into account, the analysis has been guided by a people-centred conceptual framework, the sustainable livelihood approach. This approach comprises two parts: (i) a context analysis focusing on the social network of actors in and around the logging concession in order to understand the problem at hand, and (ii) the core analysis taking a participatory approach for investigating the forest dwellers' livelihood system with regards to wildlife.

So far, we have studied wildlife management policies (what) and practices (how) as well as the stakeholders' situations, goals, strategies and outcomes (social process) and their roles and interactions (decision process) with respect to wildlife management. Based on this information, we conducted a problem analysis for wildlife management and refined the research focus accordingly. The problem analysis showed that the lack of knowledge about the sustainability of hunting presents a problem. However, the main problem from all stakeholders' perspectives is commercial wildlife use due to a lack of alternative income generating activities for forest and town dwellers. Consequently, we refined the specific research aims and adapted the research questions to contribute more directly to solving this main problem. The refined aims are: (1) to gain an understanding of the sustainability of wildlife use, (2) to understand the impact of the core and context factors on the decision-making process and strategy development of forest dwelling communities with regards to wildlife use, and (3) to understand the impact of the current wildlife management and of possible future alternatives on forest dwellers' livelihoods.



Discussing wildlife with forest dwellers, Congo Basin

Research fellow

Olivia Rickenbach, ETH Zurich, Switzerland

Supervisors

Jaboury Ghazoul and Jean-Pierre Sorg,
ETH Zurich, Switzerland

Collaborators

Robert Nasi, CIFOR, Indonesia;
Paolo Omar Cerutti, CIFOR, Cameroon;
Jerome Lewis, University College London, UK;
Tom Van Loon, Danzer Group, Switzerland

Duration

October 2010 – October 2013

Improving grazing systems with yak-cattle crossbreds in Nepal

Yaks and yak-cattle crossbreds that are called “chauries” in Nepali play a significant role for the rural livelihoods in high altitude pastoral areas of Northern Nepal. The overall aim of this project is to assess the performance and efficiency of chauries and yaks, both at different stocking densities and pasture sites as well as at different altitudes. It is assumed that chauries are superior to yaks with regard to milk yield and body weight as well as better adaptability at lower altitudes, but inferior when moved to very high altitudes. However, we are lacking accurate information on the altitudinal adaptability of different crossbreds.

The objective of the second field experiment in 2011 was, therefore, to assess the altitudinal suitability of two different F1 crossbreds named “Dimzo” (i.e. *Bos taurus* x *B. grunniens*) and “Urang” (i.e., *B. grunniens* x *B. indicus*). We compared these chaurie genotypes to a control group of purebred yaks with respect to production performance, metabolism and behaviour at two different altitudes. In August, we started with an adaptation period of six days and then realised the first experimental period at an altitude of 4700 m. For the second experimental period in October, a pasture site at an altitude of 3050 m was selected.

For each of the three genotypes, six adult lactating females were part of the experiments at both altitudes. The field data observation included measurements of various parameters which describe the metabolism: Heart rate, rectal temperature and breath rate, as well as glucose, haemoglobin and lactate concentrations in blood. Further parameters describe the productive performance: Daily milk yield, milk composition and body weight changes before and after the experimental periods. The spatial behaviour of the animals was assessed using pedometer and GPS devices. Based on the data evaluated by now, the Dimzo genotype appears to tolerate a high altitude better than the Urang genotype. The ongoing detailed data evaluation will continue to analyse the altitudinal suitability.

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Research fellow

Shanker Raj Barsila, ETH Zurich, Switzerland

Supervisor

Michael Kreuzer, ETH Zurich, Switzerland

Collaborators

Svenja Marquardt, ETH Zurich, Switzerland;
Naba Raj Devkota, Tribhuvan University, Nepal

Duration

September 2009 – August 2012



Transport of research equipment to the high altitude pasture, Northern Nepal

Access of the poor to India's National Urban Renewal Mission in a medium-sized city

In 2005, the Indian Government promised slum dwellers in 65 cities to provide improved access to basic services and other civic amenities, including tenure security and housing. This initiative was part of the urban governance reform and infrastructure investment programme *Jawaharlal Nehru National Urban Renewal Mission (JNNURM)*, which will be dovetailed into Rajiv Awas Yojana, the "Slum Free Cities" programme.

Slums are a key spatial characteristic of India's urbanisation process. While they represent important components of the emerging urban fabric, the contribution of the poor to the development of Indian cities is rarely acknowledged. Instead, the poor are treated as problems. Against this background, we will contribute to the current debate by engaging both policy analysis and urban studies from a poverty perspective.

In order to realise benefits offered by governmental programmes such as JNNURM, the location and socio-economic composition of slums seem to be the critical factors for the prospects of poor communities. First findings from the case study city Puri support this assumption. In Puri, "traditional" slums can be differentiated from "new"

slums. Oriya communities with a low socio-economic status compose traditional slums and migrant communities form the new slums. Based on our preliminary analysis, it appears that no migrant community has received support. JNNURM, hence, did not provide tenure security in slums of Puri. Instead, only households with land titles had access to JNNURM funding.

Currently, the qualitative mapping is at draft stage. We will finalise the analysis of the spatial and socio-economic structure of Puri in order to synthesise a typology of slums. Based on further literature reviews, we are planning to conduct detailed case studies in 2012/2013. In these case studies we will address questions such as: How are these communities organised formally and informally? Which strategies have they developed to improve the living conditions? What are the cultural, traditional and political resource bases they can draw upon? With whom do these communities interact (urban local bodies, wards, political/religious leaders)? Who supports them, how and why? The findings from these case studies on the community level will be visually and analytically integrated into the city-wide analysis with the goal to provide relevant insights to Indian policy-makers.



Gola Pucca Harijan Basti, a permanent slum in Puri, India

Research fellow

Andrea Gerlinde Hagn, ETH Zurich, Switzerland

Supervisors

Dietmar Eberle and Margrit Hugentobler, ETH Zurich, Switzerland

Collaborators

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Duration

October 2010–January 2014

Energy conversion of coffee husk: Fluidisation dynamics and reaction engineering

As in many sub-Saharan African countries, a large fraction of the population living in rural and peri-urban parts of Ethiopia are confronted with an acute shortage of reliable and affordable energy and energy services. However, these countries have large resources of biomass that could minimise the current energy problem if utilised properly. Ethiopia is Africa's largest producer of coffee with 400 000 tons of coffee produced each year. Its economy solely relies on agriculture. A better utilisation of coffee husk and other agricultural residues may contribute to (i) a higher productivity and profitability of the coffee milling and processing centres, (ii) a reduction of Ethiopia's dependence on oil imports, and (iii) an improved environmental health. Two important thermochemical conversion processes of biomass – pyrolysis and gasification – are promising approaches for the economic conversion of biomass into gaseous or liquid fuels. This research project aims at investigating the reaction characteristics and fluidisation dynamics of coffee husk and other agricultural residues.

A profound understanding of biomass pyrolysis is critical as it is the first step of thermochemical biomass conversion processes such as gasification, liquefaction and combustion. Knowledge of the pyrolysis kinetics is also essential for modelling and designing pyrolysis reactors. We investi-

gated the pyrolysis behaviour of four different biomasses including coffee husk using thermogravimetric analysis. We studied the products of the catalytic fast pyrolysis of biomass using a pyrolyser connected to a GC/MS¹ equipment. Pyrolysis of cellulose doped with inorganic salts is also under investigation to simulate the effect of alkaline impurities in natural biomass on the kinetics and pyrolysis products. Furthermore we implemented and applied the distributed activation energy model on experimentally derived mass loss dynamics. In addition, isothermal pyrolysis experiments were performed to determine the intrinsic pyrolysis kinetics in order to gain insight into the reaction pathways.

Fluidised beds are often employed for the gasification and pyrolysis of biomass. In addition to the thermochemical conversion process of biomass, we will thus investigate both experimentally and numerically the fluidisation dynamics of biomass. Our research findings will contribute to an efficient conversion of agricultural residues into gaseous or liquid fuels, and to the design of efficient, flexible, robust and long-lasting equipment for the energetic conversion of agricultural residues.

¹ gas chromatography and mass spectroscopy

Research fellow

Abera Melesse Ayalneh, ETH Zurich, Switzerland

Supervisor

Christoph R. Müller, ETH Zurich, Switzerland

Collaborator

A. Venkata Ramayya,
Jimma Institute of Technology, Ethiopia

Duration

October 2011 – November 2014



Wet processing of coffee, Jimma, Ethiopia

Abiotic stress resistance in cassava: A focus on post-harvest physiological deterioration

Cassava is the fourth most important staple crop in the developing world. Millions of people in Africa, Asia and Latin America depend on cassava. In Indonesia, demand for fresh cassava roots has been increasing by 0.9% per year due to an Indonesian government programme which advocates the use of local crops for food diversification.

One of the major limitations in cassava production is the post-harvest physiological deterioration (PPD). Introducing superior genotypes, which display reduced PPD, would benefit both cassava growers and processors by improving the quality of the cassava supply. PPD is characterised by a blue-black streaking of the vascular tissues and renders the roots unpalatable and unmarketable within 24–72 hours depending on the genotypes and environmental conditions. PPD forces farmers to sell fresh cassava roots or process them rapidly after harvest as root deterioration leads to price reduction and eventually restricts its use to feedstock. Losses due to PPD are getting more important with increasing distance between the production and the market site.

This project aims at characterising the natural PPD tolerance in selected cassava accessions available at the Indonesian Institute of Sciences (LIPI). In an initial phase, standardised PPD assessment protocols were established at

LIPI. Through CIAT standard method and a visual scoring system developed at the ETH Zurich, we identified the putative PPD status of selected cultivars. By applying standard evaluation methods, these results will be confirmed in a second trial. Furthermore, we will conduct enzymatic assays and metabolites measurements to a subset of 20 accessions contrasting for PPD onset. Later on, four contrasting genotypes will be selected for label-free proteomics studies at the ETH Zurich. In collaboration with the Functional Genomics Center Zurich, we will perform a correlation analysis between proteome modulation and PPD tolerance in order to decipher new markers involved in PPD tolerance.

In addition to the PPD tolerance assessment, other important parameters that allow estimating cassava value as a food or as raw material for industry will be analysed. These parameters will include amylose/amylopectin content, cyanide concentration, and beta-carotene. The existing collaboration between LIPI, associations of cassava growers and industries is particularly instrumental to ensure a rapid impact of the study on cassava production in Indonesia.



Cutting the proximal- and distal-end of fresh cassava roots for testing post-harvest physiological deterioration using the CIAT standard method

Research fellow

Ima Mulyama Zainuddin, ETH Zurich, Switzerland

Supervisors

Wilhelm Gruissem and Hervé Vanderschuren, ETH Zurich, Switzerland

Collaborator

Enny Sudarmonowati, Indonesian Institute of Sciences, Indonesia

Duration

August 2011 – August 2014

Building a sustainable rural dwelling unit (SRDU) in Ethiopia

The United Nations Millennium Development Goals largely neglect the issue of rural housing despite its particular importance. The Ethiopian rural population – about 80% of the estimated total population of 80 million people – is mostly living in housing units that are not only substandard but also incompatible to the current transformative political, economic and social ambitions. This calls for an immediate intervention which is targeting a systematic improvement of the housing situation in rural Ethiopia. Sustainable Rural Dwelling Unit (SRDU) is a research project being undertaken by the housing chair of the Ethiopian Institute of Architecture, Building Construction and City Development (EiABC) in collaboration with the North-South Centre of the ETH Zurich. The project is funded by the Arthur Waser Foundation, Switzerland.

Our project aims at contributing towards the improvement of rural housing in Ethiopia. It will draw lessons from the vernacular architecture of a rural area and incorporate them into a SRDU prototype. We will focus on a one-to-one construction of a housing prototype that would primarily embody the positive elements of vernacular architecture within the framework of sustainability – sustainability understood in terms of responsiveness to the context, cost-efficiency, use of appropriate building materials and construction techniques, use of renewable energy, skill transfer,

and local capacity building. In the first phase of the project, we recorded and studied the existing rural housing (vernacular architecture) and local building materials. We constructed a prototype (SRDU 1), which uses renewable energy. In the second phase, we will construct the SRDU 2 based on the findings of the first phase. SRDU 1 has been finalised and SRDU 2 is under construction.

The research area is in Gubrie, Guraghe Zone, located 175 kilometres southwest of Addis Ababa, the capital city of Ethiopia. The footprint size of the first completed rectangular prototype is about 65m². The initial spatial assumption for the design and construction of the unit is based on the accommodation in a typical rural hut where the family residence and the animal barn spaces are integral parts. Additionally, four semi-outdoor pocket spaces of 1.5m² each – defined by protruding buttresses – are included in the functional programme of the SRDU 1. Our project also includes the use of renewable energies such as solar energy and biogas.

From an architectural point of view, our research project focuses on an innovative design that is inspired by the vernacular architecture of the area and that incorporates the requirements of a healthy habitation. The architecture is blending well with the site. Both the choice of the dominant

Project leader

Elias Yitbarek, Ethiopian Institute of Architecture, Building Construction and City Development, Ethiopia

Collaborator

Dirk Hebel, ETH Zurich, Switzerland

Partner institutions

Bete-Guraghe Cultural Centre, Ethiopia;
Guraghe Administration Zone, Ethiopia

Duration

September 2010 – October 2012



On-site training of bamboo roof construction, Ethiopia

building materials and the use of renewable energy sources result in little interference with the environment. Furthermore, the SRDU is constructed using local craftsmanship and keeping the identity of the vernacular spatial order. Respect for the cultural identity is further reflected through the incorporation of symbolic cultural elements and the participation of the local elders. All these aspects are leading to an increased acceptance of the building by the local population. In terms of realisation, we used materials such as earth, bamboo and straw that are abundantly available. The wall rests on a stone gravel foundation and is made of earth blocks of three varied dimensions. These earth blocks contain a straw mix. The roof is made of bamboo leaves which are applied on a basket-like bamboo framework. The interior of the unit includes a partial mezzanine floor being constructed using a light-weight graded earth-fill on vaults built with soil blocks.

Feedback from stakeholders confirms that the research project has created awareness and has fostered the dialogue among professionals and the local community in the region. In addition, the project led to an exemplary partnership between the local administrators, an academic institution and the local people. By facilitating the exchange between students and local artisans during the construction of the SRDU 1, a cross-cultural transfer of knowledge

and skills was achieved. We also fostered capacity building through the training of 13 persons who were strategically selected from different parts of rural Ethiopia. Because of the transformable and adaptable nature of the SRDU prototype (rectangular, circular, big or small), different income groups could be addressed. Additional merits of the SRDU might be that its construction has the potential of creating local jobs and generating income for the trained artisans. Furthermore, transforming the traditional way of building into the new one is thought to support an adaptive transformation of the rural lifestyle.



Corner view of completed SRDU 1, Ethiopia

Arthur Waser Foundation

The Arthur Waser Foundation is a Lucerne-based registered charity, founded in 1999 by Arthur Waser, the owner of the Arthur Waser Group. The foundation has the mandate to generate revenue from economical or entrepreneurial activities and to use the proceeds to support charity projects in Switzerland as well as in developing countries, mainly Africa. The foundation has recently been funding construction and capacity building projects in Ghana, Tanzania and Ethiopia.

In 2010, the Arthur Waser Foundation decided to support the SRDU project in Ethiopia. The initial contacts between the Arthur Waser Foundation and ETH Foundation led to a financial contribution to the North-South Centre for the implementation of the project. Implementing partner in Ethiopia is the Ethiopian Institute for Architecture, Building Construction and City Development (EiABC) in Addis Ababa.

This initial investment in a one-year pilot project led to a longer-term partnership between the Arthur Waser Foundation and the ETH Zurich starting in 2012.

Assessing product-related impacts of land use on biodiversity at global scales

Many agricultural commodities consumed in the industrialised world, for example coffee, soya or palm oil, are produced in developing countries and emerging economies. Environmental impacts and the associated societal costs occurring during the production of these commodities remain in the region of production. Such impacts are biodiversity loss, soil and water degradation, and human health impacts. In this project, we aim at quantifying these impacts with a focus on biodiversity loss. We also aim at developing a compensation mechanism in the form of an international payment scheme. We thus further develop life cycle assessment (LCA) methods, which can assess the overall impact along the entire life cycle of a product.

This subproject aims at developing a global, spatially differentiated assessment method of land use impacts on biodiversity that is compatible with LCA. To quantify the land use impacts, the relative difference in biodiversity between a production system (for example, a soya plantation) and a reference situation (for example, an adjacent rain forest) within the same region was assessed. Data was derived from a global meta-analysis of peer-reviewed publications and from national biodiversity monitoring data. The magnitude of impacts on biodiversity differed across world

regions, across different species groups, and across biodiversity indicators. On world average, annual crops showed significantly higher impacts than most other investigated land use types, for example agroforestry or pasture.

Our findings can be used to roughly quantify impacts of land use on biodiversity in studies where the exact location of production is not known – which is often the case for globally traded commodities. If more information on the origin of products is known, then a more detailed assessment is recommended. We will develop a regional assessment method as a next step and will apply it to the case of East Africa, where tea and coffee are major export products. Such a method will allow assessing impacts more accurately by including aspects of landscape configuration and spatial patterns in biodiversity.

Project leader

Stefanie Hellweg, ETH Zurich, Switzerland

Supervisors

Thomas Köllner, University of Bayreuth, Germany;
Roland Scholz, ETH Zurich, Switzerland

Principal investigator

Laura de Baan, ETH Zurich, Switzerland

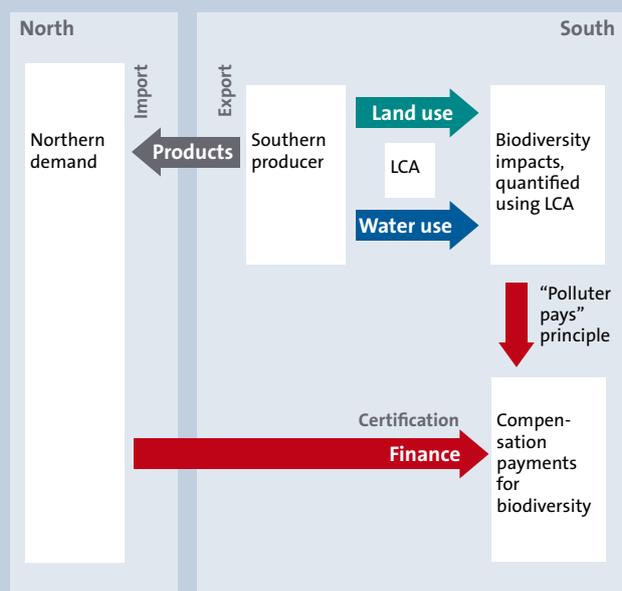
Collaborators

Rob Alkemade, Netherlands Environmental Assessment Agency, Netherlands;
Gemma Shepherd and Mario Boccucci, UNEP, Kenya

Duration

July 2009 – July 2012

Within the UNEP-ETH collaborative project “myEcosystem”, two doctoral students are developing methods to assess production-related impacts of land and water use on biodiversity, using life cycle assessment. A third doctoral student is developing a framework for compensating these impacts based on the “polluter pays principle”. The methods are applied in several case studies, amongst others by a postdoctoral scientist in Peru.



Overview of the linkages in the UNEP research project “myEcosystem” (see pages 76–79)

Assessing impacts of water use on wetlands: Local case study and global approach

70% of global water withdrawal is for irrigation, which allows expanding agriculture into areas previously considered unsuitable. Consequently, numerous aquifers and surface water bodies are unsustainably used and, hence, being depleted. The associated impacts on the different ecosystems are multifaceted and excessively complicated. At the same time, up to now 50% of all wetlands have been lost globally, mostly due to agricultural drainage. In spite of this precarious situation, a comprehensive assessment for estimating the impact of water use on ecosystems is still missing within the framework of life cycle assessment. Therefore, the aim of this study is to develop a methodology for estimating the impact of agricultural water use on wetlands by using both local and global approaches.

We performed a case study in the valley of Chancay-Huaral at the Peruvian coast. We only included the lower part of the valley (1245 km²) into the case study, because most agricultural activities are located there and because most people live there. In this lower, largely desert-like valley, 260 km² are used for irrigated agriculture and there is one larger area with natural vegetation, namely the groundwater-fed wetland Santa Rosa (36 ha). This wetland is one of the most species-diverse coastal wetlands in Peru, harbouring over 50 plant species and over 70 bird species.

In a workshop with local stakeholders, we designed several scenarios for future agricultural development such as changed crop compositions or altered irrigation techniques. For each scenario, a water balance was developed. Based on the results we could estimate the potential change in the wetland area and the associated impacts on the wetland's biodiversity due to water withdrawals from surface water and groundwater consumption. Surprisingly, water withdrawals from the river for furrow irrigation lead to benefits for Santa Rosa. This is due to the fact that the aquifer is artificially recharged and that it thus profits from additional recharges. Groundwater consumption, on the other hand, has a negative impact. As the results for all scenarios are very close, a generalised factor can be used for the planning of future agricultural activities and conservation strategies in the region.

This case study is a first step towards the development of a global methodology. A similar but simplified approach is currently being applied to calculate the impact factors for all wetlands of international importance as defined in the Ramsar Convention.



Furrows for irrigation in a tree plantation, Chancay-Huaral, Peru

Project leader

Stefanie Hellweg, ETH Zurich, Switzerland

Supervisors

Annette Köhler, PE International, Switzerland
Stephan Pfister, ETH Zurich, Switzerland

Principal investigator

Francesca Verones, ETH Zurich, Switzerland

Collaborators

Patrick M'mayi and Thomas Chiramba, UNEP, Kenya;
Ricardo Jimenez, Terra Nuova, Peru;
Beatriz Rosario Alcántara Medrano,
Gobierno regional Lima, Peru

Duration

September 2009 – September 2012

Compensating biodiversity loss due to land use and water use in agriculture

Compensation mechanisms for certain environmental impacts have been implemented in specific contexts in various world regions; for example, payments for ecological services such as carbon sequestration. However, schemes that deal with the overall entity of biodiversity remain elusive because, unlike carbon, biodiversity cannot be easily defined and parcelled into discreet units to be traded. A successful mechanism needs to conform to the immense complexity and multifaceted nature of biodiversity – rather than falsely and simplistically representing biodiversity as a tangible commodity that conforms to the requirements of market theory.

This project focuses on basing a compensation mechanism around what conservationists and ecologists do best: Characterise biodiversity (be it individual species or whole ecosystems), quantify its threats, and pinpoint conservation activities necessary to ensure its persistence. Since conservation has both production and opportunity costs, it is possible to estimate the total funding required to meeting regional biodiversity targets. A precautionary approach, for example, would ensure that all species and ecosystems are viably represented by protected areas – locally, regionally

and globally. The “polluter pays principle” (PPP) then dictates that the drivers of biodiversity loss are responsible for funding the corresponding conservation effort. Adequate compensation for biodiversity loss caused by land use and water use, or their derived agricultural products, can then be quantified according to the respective scenario.

Our framework is currently being applied in Central Kenya where major export crops such as tea and coffee occupy a considerable portion of the land area. The cultivation of these crops is driving land use change and water scarcity either directly, or through displaced production of subsistence crops. Ecological data at different scales is being assembled and combined with socio-economic information collected in a sister project headed by the University of Nairobi. The outcome will be a map of conservation priorities with an estimation of the total funding shortfall for achieving an “optimal” conservation target. According to the PPP, this funding shortfall will be apportioned to all processes driving biodiversity loss in the case study region. Socio-political feasibility of conservation is also being assessed in order to realistically address the fact that a lack of funding is usually not the only barrier to resolving such complex issues.

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Project leader

Stefanie Hellweg, ETH Zurich, Switzerland

Supervisors

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Jan Beck, University of Basel, Switzerland;
Annette Köhler, PE International, Switzerland

Principal investigator

Michael Curran, ETH Zurich, Switzerland

Collaborators

Boniface Kiteme, Centre for Training and Research in Arid and Semi Arid Lands Development, Kenya;
Winfred Musila, National Museums of Kenya, Kenya;
David Kuria, Kereita Environment Volunteers and East African Wildlife Society, Kenya;
Nicolas Bertrand and Benjamin Simmons, UNEP, Switzerland

Duration

July 2009 – July 2012



Tea represents a major cash crop in the once forested montane regions of Kenya, accounting for a large proportion of land and water use for small and large farmers alike.

Life cycle assessment of agricultural production in a Peruvian watershed

Due to its favourable climate and closeness to the capital city Lima, the valley of Chancay-Huaral at the Peruvian coast is an important region for agricultural production. The production is entirely dependent on irrigation with the dominant crops being fruits, vegetables, maize and potatoes. A life cycle assessment (LCA) was performed for eight dominant crops representing the agricultural production of the whole region. We estimated the impact categories eutrophication, acidification and human toxicity at a global and regional scale. Furthermore, we assessed the regional effects of irrigation water withdrawal and consumption on biodiversity. Various future scenarios were set up to obtain regionally relevant information regarding possible future development options for regional agricultural production. Local stakeholders were involved in the definition process of the scenarios, resulting in an adequate reflection of their demands.

The elements that contribute most to the results are the amounts of production inputs such as fertilisers, pesticides and irrigation water applied on the fields. Among the estimated impact categories, both eutrophication and human toxicity can be considered as hot spots for the region. An

increment of the area cultivated with mandarins and an increased use of a drip-irrigation system instead of the common gravity and furrow irrigation system would imply an improvement of the actual situation by 2020. Relative to the year 2010, nitrate leaching would be reduced by 13%–16% and human toxicity by 17%–26%. An increase of asparagus cultivation, on the other hand, could be considered as worst option. Although nitrate leaching and human toxicity potentials would be lower than in 2010, reductions of less than 2% would be contrasted with an acidification increase of 30%. The asparagus scenario is also the only scenario causing an increased resource input for land and water. A continuation of the past growth trend is no good option either. Under this option an increase of nitrate leaching (+23%) and acidification (+18%) and a reduction of human toxicity potential by 17% is prognosticated.

Our findings will provide an accurate basis for recommendations for the agricultural management in the region. In addition, this regional LCA is a valuable database for LCA practitioners estimating the impact of food production on an international level.



Harvest of peaches in Chancay-Huaral, Peru

Project leader

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Duration

June 2009 – March 2012

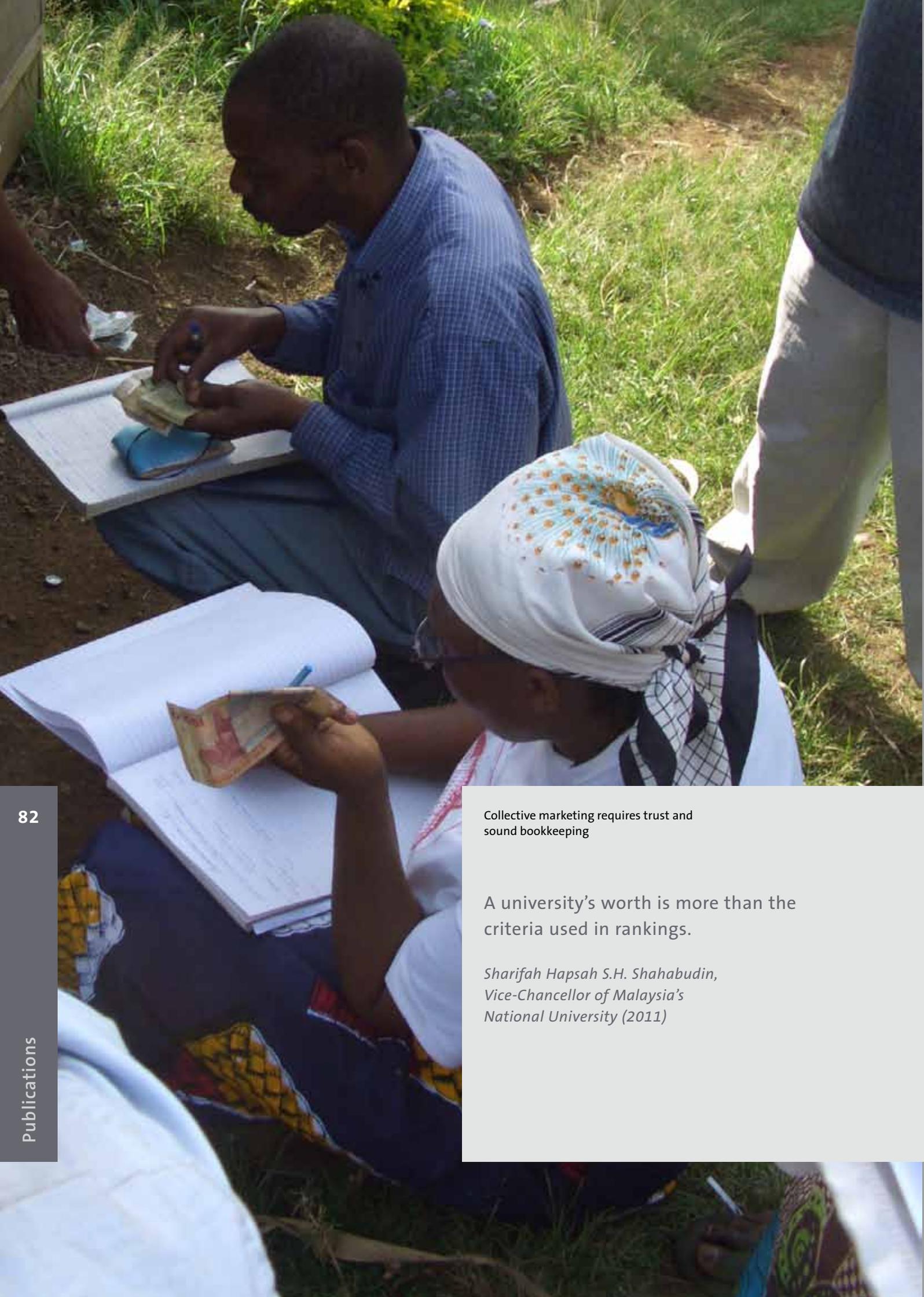
Short-term activities

Funds by the ETH Zurich and the Swiss Agency for Development and Cooperation permit the North-South Centre to offer small grants to its members for short-term projects or as seed money. These grants enable them to establish new partnerships or strengthen impact generation by implementing given research results. Seed money projects are always carried out in partnership with scientists from developing countries. In addition, the North-South Centre

supports teaching stays where ETH scientists or ETH emeriti lecture at partner institutions in the South. Finally, two types of activities are funded for visiting scientists: Research stays of scientists from the South at the ETH Zurich, and support for the attendance of scientists from developing countries at conferences organised by the ETH Zurich.

Topic	Scientist(s)	ETH unit
Short-term projects		
The concept of diversity in feeding: Employing biodiversity to improve smallholder ruminant systems in the South	Janina Meier, Svenja Marquardt, Michael Kreuzer	Department of Agricultural and Food Sciences, Animal Nutrition
Reduction of methane emission from rice paddies through intercropping	Gurbir Singh Bhullar, Peter Edwards, Harry Olde Venterink	Department of Environmental Sciences, Plant Ecology
Establishing permanence in REDD+ schemes	Tim Schlöndorn, Astrid Zabel, Marcella Veronesi, Stefanie Engel	Department of Environmental Sciences, Environmental Policy and Economics
Communication of coping and adaptation strategies for climate change in tropical regions in East Africa	Juanita Schlöpfer-Miller, Eugenio Tisselli, Angelika Hilbeck	Department of Environmental Sciences, Plant Ecology
Environmental iTools: Mobile applications for land use decision support in developing countries	Lian Pin Koh	Department of Environmental Sciences, Applied Ecology and Conservation
Effective coastal conservation planning in South Africa	Christian Pohl	Department of Environmental Sciences, Environmental Philosophy
Seed money		
Earthquake hazard mapping in Bhutan	György Hetényi	Department of Earth Sciences, Geochemistry and Petrology
Climate change modelling in Chile – Ecosystems and sediment transport	Francesca Pellicciotti	Department of Civil, Environmental and Geomatic Engineering, Hydrology and Water Resources Management
Improving the design of payments for adopting renewable energies in China	Pan He, Stefanie Engel	Department of Environmental Sciences, Environmental Policy and Economics
Arbuscular mycorrhizal symbiosis and wheat mineral nutrition in saline soils	Jan Jansa	Department of Agricultural and Food Sciences, Plant Nutrition
Feasibility and sustainability of vermiculture on locally produced organic wastes to promote income of Vietnamese small-scale farms with aquacultural activities	Jana Müller, Michael Kreuzer	Department of Agricultural and Food Sciences, Animal Nutrition

Topic	Scientist(s)	ETH unit
The role and management of <i>Dioscorea</i> species in home gardens of smallholders' farms in Sri Lanka	Emmanuel Frossard	Department of Agricultural and Food Sciences, Plant Nutrition
Elucidation of the role of African <i>Streptococcus infantarius</i> with regards to food safety and epidemiology	Christoph Jans, Leo Meile	Department of Agricultural and Food Sciences, Food Biotechnology
Phosphorus, carbon and nitrogen interactions in highly weathered tropical pasture soils: elemental distribution in soil aggregates	Astrid Oberson, Else Bünemann, Emmanuel Frossard	Department of Agricultural and Food Sciences, Plant Nutrition
An ecosystem service approach to agricultural security in a sacred landscape mosaic	Smitha Krishnan	Department of Environmental Sciences, Ecosystem Management
Visiting scientists		
Modelling of water transport through the dense reservoir of the Upper Jaguaribe Basin	George Leite Mamede and José Carlos de Araújo, Universidade Federal do Ceará, Fortaleza, Brazil	Department of Civil, Environmental and Geomatic Engineering, Computational Physics for Engineering Materials (Hans Jürgen Herrmann)
Participation of doctoral students from developing countries in the winter school	Lipokmar Dzuwichu, Nehru University, New Dehli, India; Harsha Man Maharjan, Tribhuvan University, Kathmandu, Nepal	Department of Humanities, Social and Political Sciences, History of the Modern World (Harald Fischer-Tiné)
Water governance and economics in the Kafue River Basin	Thomas Simfukwe, Ministry of Agriculture and Cooperatives, Lusaka, Zambia	Department of Humanities, Social and Political Sciences, NADEL (Rolf Kappel)
Impact of shrub encroachment on plant diversity and herbivory in the Kafue Flats floodplain	Griffin Shanungu, Zambia Wildlife Authority, Chilanga, Zambia	Department of Environmental Sciences, Plant Ecology (Peter Edwards)
International conference: The Cold War and the Postcolonial Moment	Mridula Mukherjee, Bhashyam Kasturi, Chandrashekhar Dasgupta and Rajiv Sikri, Nehru Memorial Museum and Library, New Delhi, India; Aditya Mukherjee, Jawaharlal Nehru University, New Delhi, India; Ivan Ivekovic, American University, Cairo, Egypt	Department of Humanities, Social and Political Sciences, History of the Modern World (Harald Fischer-Tiné)
Teaching stays		
University of Peradeniya, Sri Lanka	Caspar Wenk (emeritus)	Department of Agricultural and Food Sciences
Expansion of existing e-Callisto network	Christian Monstein	Department of Physics, Cosmology



Collective marketing requires trust and sound bookkeeping

A university's worth is more than the criteria used in rankings.

*Sharifah Hapsah S.H. Shahabudin,
Vice-Chancellor of Malaysia's
National University (2011)*

Publications

Refereed publications

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Park, J.H., Heuer, S., Gruissem, W., Bhullar, N.K., 2011: Allele mining for abiotic stresses (drought and phosphorus deficiency) in rice. Zurich-Basel Plant Science Center (PSC) Symposium, Zurich, Switzerland, November 4.

Invited oral presentations

Abbeddou, S., 2011. Animal nutrition in dry areas. Vorträge im Rahmen des Berufungsverfahren "Tierernährung und Weidewirtschaft in den Tropen und Subtropen", University of Stuttgart-Hohenheim, Hohenheim, Germany, July 17.

Andrade de Sá, S., 2011: Dynamics of indirect land-use change: Empirical evidence from Brazil. LAMETA Seminar, Montpellier, France, November 17.

Andrade de Sá, S., 2011: Dynamics of indirect land-use change: Empirical evidence from Brazil. Rencontres de la Biodiversité et du Développement Durable, Paris, France, September 16.

Andrade de Sá, S., 2011: Dynamics of indirect land-use change: Empirical evidence from Brazil. Workshop on Land-Use and Deforestation, London School of Economics, London, England, July 18–22.

Bartl, K., 2011: Análisis de Ciclo de Vida (LCA) para dos sistemas de producción de leche en la sierra y costa del Perú. Simposio Internacional: Perspectivas sobre el calentamiento global y la ganadería en los países en desarrollo de América Latina, Universidad Nacional Agraria La Molina, Lima, Peru, May 10–12.

Bartl, K., 2011: Respuesta del perfil de ácidos grasos en leche, estatus metabólico y nivel productivo de vacas lecheras Brown Swiss y Criollo a diferentes dietas y alturas. XVIII Curso de Actualización, Universidad Nacional Agraria La Molina, Facultad de Zootecnia, Lima, Peru, October 25.

Bartl, K., 2011: Análisis de Ciclo de Vida (LCA) de la leche producida en sistemas familiares en la costa y sierra del Perú. XVIII Curso de Actualización, Universidad Nacional Agraria La Molina, Facultad de Zootecnia, Lima, Peru, October 25.

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Bhullar, G.S., 2011: Reducing climate change not the food production. Bühler AG, Uzwil, Switzerland, March 17.

Bhullar, N.K., 2011: Improving rice for its nutritional value and harnessing genetic diversity to identify novel genes against biotic and abiotic stresses. NSTDA-ETH Workshop on Plant Sciences, National Center for Genetic Engineering and Biotechnology (BIOTEC), Thailand, July 6–8.

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Contzen, S., 2011: Negotiating rural development: The role of poor people in the Honduran Poverty Reduction Strategy. Rethinking Development in an Age of Scarcity and Uncertainty. New Values, Voices and Alliances for Increased Resilience, EADI/DSA Conference, University of York, UK, September 19–22.

Di Falco, S., Veronesi, M., 2011: On adaptation to climate change and risk exposure in the Nile basin of Ethiopia. Department of Economics, University of Innsbruck, Austria, March 23.

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- Dorn, S. 2011: Insect-plant interactions in the orchard ecosystem: From field to behavioral and molecular levels. Northwest A&F University, Shaanxi, China, June 7.
- Dorn, S., Najjar-Rodriguez, A., Piñero, J., 2011: Synergistic plant-derived volatile mixtures to attract the oriental fruit moth, a warm-adapted fructivorous species. Symposium on Contribution of Chemical Ecology to IPM in the Tropics, Entomological Society of America (ESA) Annual Meeting, Reno, USA, November 13–16.
- Egji, I., 2011: Assessment of iron bioavailability using stable isotope techniques. Stable Isotope Techniques to Design Effective Food Fortification Strategies in Settings with High *Helicobacter pylori* Infection, First Research Coordination Meeting, IAEA Headquarters, Vienna, Austria, September 12–14.
- Engel, S., 2011: Institutional dimensions of PES—An overview of selected research. International Conference on “Payments for Ecosystem Services and their Institutional Dimensions”, Berlin, Germany, November 10–12.
- Frossard, E., Dumondel, M., Haller, T., Kiba, I.D., 2011: Urban agriculture: Gadget or necessity for sustainable cities? Cities in Search of their Hinterland—Designing Sustainable Food Systems, Symposium, Future Cities Laboratory, Singapore ETH Center for Global Sustainability, Singapore, December 9.
- Gheysens, J., Günther, I., 2011: Risk aversion in losses, risk taking in faith. Center for African Economies, Oxford University, Oxford, UK, March 20–22.
- Gheysens, J., Günther, I., 2011: Risk aversion in losses, risk taking in faith. DIAL Conference, University of Paris-Dauphine, France, June 30–July 7.
- Gheysens, J., Günther, I., 2011: Risk aversion in losses, risk taking in faith. Spring Meeting of Young Economists, University Of Groningen, the Netherlands, April.
- Gheysens, J., Günther, I., 2011: Risk aversion in losses, risk taking in faith. Poverty and Behavioral Economics, (UNU-WIDER), Helsinki, Finland, September 30–October 1.
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- Günther, I., 2011: Was bedeutet Wirkung in der Entwicklungszusammenarbeit? Wirken und Bewirken, ZEW, Berne, Switzerland, September 13.
- Günther, I., 2011: Impact analysis of water infrastructure. Federal Ministry for Economic Cooperation and Development (BMZ), Bonn, Germany, September.
- Günther, I., 2011: The value of health insurance for the poor. Swiss Tropical and Public Health Institute (Swiss TPH), Basel, Switzerland, April 5.
- Hetényi, G., Berthet, T., 2011: Earthquake hazard mapping in Bhutan: progress report and future plans. Department of Geology and Mines, Thimphu, Bhutan, December 2.
- Hirsch Hadorn, G., 2011: Problem-oriented research: Challenges with values in environmental research. Understanding and Managing Ecological Novelty, International Conference, Monte Verita, Ascona, Switzerland, September 8.
- Hirsch Hadorn, G., Allenspach, U., Brun, G., 2011: Bewertungsverfahren und Nachhaltigkeit. Montagskolloquium für die Praxis zum Thema Externalitäten des Waldes und der Forstwirtschaft in der Schweiz. ITES, ETH Zurich, Switzerland, January 24.
- Hurrell, R.F., 2011: Optimizing iron fortification with isotopic studies. IAEA Stable Isotope Course, Bangalore, India, January 12–14.
- Hurrell, R.F., 2011: Iron interventions in malaria endemic areas: Implications for research. WHO Nutrition Guidance Expert Advisory Group, Geneva, Switzerland, March 14–18.
- Hurrell, R.F., 2011: Meeting micronutrient requirements for health and development. The influence of inflammatory disorders and infection on iron absorption and the efficacy of iron fortified foods. 70th Nestlé Nutrition Institute Workshop Program, Cebu, Philippines, March 27–30.
- Hurrell, R.F., 2011: Iron and malaria: Absorption, efficacy and safety. IAEA Second Research Coordination Meeting on Stable Isotope Techniques in the Development of Nutritional Interactions for Infants and Children with Malaria, TB and Other Infectious Diseases, Vienna, Austria, June 6–8.
- Hurrell, R.F., 2011: Safety and efficacy of iron supplements in malaria endemic areas. Critical Micronutrients in Pregnancy, Lactation and Infancy, EURRECA/ENA scientific workshop, Munich, Germany, June 14–16.
- Hurrell, R.F., 2011: Food fortification: an overview on how fortified foods can improve the nutritional status of infants and young women. Food Fortification During The “1000 Days” for a Good Start in Life, IAEA Technical Meeting, Vienna, Austria, September.
- Hurrell, R.F., 2011: Efficacy of fortified food for the Middle East and North Africa. Morocco Nutrition Society, Marrakesh, Morocco, October 21–23.
- Kinzelbach W., Meier P., Köck F., Tilmant A., 2011: Water allocation between hydropower, agriculture, and nature. Example: the Zambezi-Kafue river basin. Modelcare 2011, UFZ Leipzig, Germany, September 18–22.
- Köck F., Meier P., Kinzelbach W., Hajnsek I., 2011: Modeling of the Kafue Flats wetland, Zambia: Use of a TanDEM-X DEM and flood maps to improve the hydraulic model of overland flow and water retention in the floodplains. TanDEM-X Science Team Meeting, German Aerospace Center, Oberpfaffenhofen, Germany, February 17–18.
- Koh, L.P., 2011: Balancing societies’ priorities: Reconciling agricultural expansion, forest protection and carbon conservation. Seminar Series, School of Forestry and Environmental Sciences, Yale University, USA, September 21.
- Koh, L.P., 2011: Balancing societies’ priorities: The need for avant-garde research & tools. Complex Systems Working Lunch Seminar, Uppsala University, Sweden. November 29.

- Koh, L.P., 2011: Balancing societies' priorities: the need for avant-garde research & tools. Linking Green Economies, Forests and Biodiversity, Public Symposium and Workshop, University of Utrecht, Netherlands, November 21.
- Michaelowa, K., 2011: Climate business for poverty reduction? The Role of the World Bank, Jahrestagung SVPW, Basel, Switzerland, January 13–14.
- Michaelowa, K., 2011: Development aid for renewable energy and energy efficiency: Old wine in new bottles? Symposium on Energy and Development, Indian Institute of Management, Bangalore, India, November 28.
- Michaelowa, K., 2011: Development aid in the energy sector. Symposium on Energy and Development, Graduate Institute, Geneva, Switzerland, October 5.
- Michaelowa, K., 2011: India—An emerging power in international climate negotiations. Side Event, UNFCCC Meeting, Bonn, Germany, June 7.
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List of acronyms

All units of the ETH Zurich are in italics.

ALP Agroscope Liebefeld-Posieux Research Station
ART Agroscope Reckenholz-Tänikon Research Station
BSc Bachelor of Science
CCES *Competence Centre Environment and Sustainability of the ETH Domain*
CGIAR Consultative Group on International Agricultural Research
CIAT International Center for Tropical Agriculture
CIFOR Center for International Forestry Research
CINFO Center for Information, Counselling and Training for Professions Relating to International Cooperation
CIRAD Centre de coopération internationale en recherche agronomique pour de développement, France
ClimPol Climate Policy Making for Enhanced Technological and Institutional Innovations
CSRS Centre Suisse de Recherches Scientifiques en Côte d'Ivoire
D-AGRL *Department of Agricultural and Food Sciences*
D-ARCH *Department of Architecture*
D-BAUG *Department of Civil, Environmental and Geomatic Engineering*
D-BIOL *Department of Biology*
D-ERDW *Department of Earth Sciences*
D-GESS *Department of Humanities, Social and Political Sciences*
D-INFK *Department of Computer Science*
D-ITET *Department of Information Technology and Electrical Engineering*
D-MTEC *Department of Management, Technology and Economics*
D-UWIS *Department of Environmental Sciences*
DR Congo Democratic Republic of the Congo
Eawag Swiss Federal Institute of Aquatic Science and Technology
EiABC Ethiopian Institute of Architecture, Building Construction and City Development
Embrapa Brazilian Agricultural Research Corporation
Empa Swiss Federal Laboratories for Materials Science and Technology
EPFL Swiss Federal Institute of Technology Lausanne
ESSA École Supérieure des Sciences Agronomiques
FAO Food and Agriculture Organization of the United Nations
FOFIFA Centre National de Recherche Appliquée au Développement Rural
GIZ Deutsche Gesellschaft für Internationale Zusammenarbeit (formerly GTZ)
GlobalTech Global Alliance of Technological Universities
GTZ German Technical Cooperation
HAFL Bern Applied University, School of Agricultural, Forest and Food Sciences (formerly SHL)

ICARDA International Center for Agricultural Research in the Dry Areas
ICT4D Information and communication technology for development
IED *Institute for Environmental Decisions*
IFPRI International Food Policy Research Institute
IHEID Graduate Institute of International and Development Studies
IIA *International Institutional Affairs*
IITA International Institute of Tropical Agriculture
ILRI International Livestock Research Institute
INERA Institut de l'Environnement et Recherches Agricoles
IRRI International Rice Research Institute
ISEAL Alliance Global Association for Social and Environmental Standards
ISP Bukavu Institut Supérieur Pédagogique de Bukavu
IUT Isfahan University of Technology
KARI Kenya Agricultural Research Institute
KFPE Swiss Commission for Research Partnerships with Developing Countries
KIST Kigali Institute of Science and Technology
MSc Master of Science
NADEL *Postgraduate Studies for Developing Countries*
NCCR North-South National Centre of Competence in Research North-South
REDD Reducing emissions from deforestation and forest degradation
RFPP Research Fellow Partnership Programme for Agriculture, Forestry and Natural Resources
Sandec Department of Water and Sanitation in Developing Countries, Eawag
SDC Swiss Agency for Development and Cooperation
seco State Secretariat for Economic Affairs
SFIAR Swiss Forum for International Agricultural Research
SHL Swiss College of Agriculture
SIBS Shanghai Institutes of Biological Sciences
SNSF Swiss National Science Foundation
SPLASH European Research Area Network of the European Water Initiative
Swiss TPH Swiss Tropical and Public Health Institute
UNAM National Autonomous University of Mexico
UNEP United Nations Environment Programme
UNESCO United Nations Educational, Scientific and Cultural Organization
WBGU German Advisory Council on Global Change
ZALF Leibniz Centre for Agricultural Landscape Research
ZEF Center for Development Research
ZESCO Zambia Electricity Supply Corporation

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