



IHDP Open Meeting 2009

7th International
Science Conference on the
Human Dimensions of
Global Environmental Change

26-30 April 2009
World Conference Center Bonn
UN Campus
Bonn, Germany

The Social Challenges of Global Change

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Time: Monday 27 April, 16:00 - 17:30. Session: A060

Demographic Trends and Food Security

Location: Verwaltungsanbau World Conference Center Bonn, Room P 87

Convenor: Lori Hunter, University of Colorado at Boulder, United States

Approximately one quarter of all children in developing countries remain undernourished and underweight, according to The United Nations 2008 Millennium Development Goal Report. Further, climate change is likely to undermine food production in the developing world, compounding the burden on those already most vulnerable. More specifically, the Food and Agricultural Organization projects that rainfed agriculture in marginal areas in semi-arid and sub-humid regions is most at risk of impacts from global environmental change. These socio-economic and environmental factors ultimately shape the food security of billions of global residents – defined by the World Bank as access at all times to enough food for an active, healthy life.

To inform understanding of the various socio-economic and environmental aspects of food security, this session presents current research on social, demographic and environmental dimensions of food security in a variety of cultural settings. Focusing on China, the research presented examines demographic pressures, land carrying capacity and novel modeling techniques to simulate the food provision capacity of a variety of ecosystems. With a focus on Africa, current research is presented examining important shifts in livestock production as well as the environmental and food security implications of the HIV/AIDS pandemic. Finally, the Philippines offers a fascinating and important setting in which to explore land demand as related to population growth given the nation's 10-fold population increase over the 20th century. In all, this session offers a variety of important scholarship shedding light on the myriad complexities and implications of current food production processes.



Study on Land Carrying Capacity in Northeast China: Issues and Countermeasures

Presenter: Yan Wei, Xian University of Finance and Economics, China

Authors: Yan Wei (1), Hui Li (1)

School of management, Xi'an University of Finance and Economics, Xi'an, Shaanxi province, China (1), Center for Northeast Asian Studies of Jilin University, Changchun, Jilin province, China (2)

Introduction: The existing arable lands in northeast China makes up about 16.5% of the total arable lands in China. This paper focuses on analysis of the current situation of land carrying capacity and existing ecological crisis in northeast China. Some policy proposals for improvement of the carrying capacity of lands in northeast China is also given. **Methods:** Data used in this paper are mainly from ad hoc surveys and statistical yearbooks from 1995 to 2005. Methods of system dynamics and statistics are combined to analyze the current situation of land carrying capacity in northeast China. **Results:** First, the reserved arable land resources have been reclaimed too fast, and the per capita arable land has been decreasing. The per capita arable land of people in northeast China has declined by 27.36% in the past ten years; Second, Soil of the blackland has been washed away substantively and the deterioration of land ecological environment has got worsened. The content of organic matter in blackland has also declined from 6%-15% at the beginning to about 1.98% now. Last, The utilization and cultivation of lands are not rational, resulting in the deterioration of land productivity. **Discussion:** Major projects like Conversion of Farmland to Forests and Natural Forest Protection should be well implemented to consolidate the achievements in ecological construction. Ecological agriculture System construction should be pressed forward to protect the land resources and build up a resource-saving social economic system. Meanwhile, the forestry economy in northeast China should be developed energetically.

The Effect of Demographic Components on the Situations and Trend of Food Security in Mainland China

Presenter: Jiehua Lu, Beijing University, China

Authors: Jiehua Lu (1), Ye Wang (2)

Department of Sociology, Beijing University, Beijing, China (1), Institute of Population Research, Beijing University, Beijing, China (2)

Due to the future growing population size in Mainland China, food security has been becoming a main concern among international communities since 1990s. This paper analyzes the changing situations of food security since 1990s based on the time series data and highlights the effect of demographic components (both population size and structure) on supplies of food in Mainland China by using method of component analysis. Meanwhile, this paper also projects the future supply and demand of food between 2000 and 2030 employing both trend analysis and population projection methods in China. Findings turn out that there keeps an overall balance in terms of supply and demand of food not only at present, but also in future if per capita food consumption main constant as population size increases. However, there will be some deficits if age structure and food structure are considered, because the food structure could witness a great change as population structure changes. The key issue of food security in Mainland China is now the more uneven distribution of food resources and incomplete nutrition structure. This paper at last proposes some main policy frameworks in order to increase the efficiency of food usage and release the



pressure of food security in Mainland China.

Examining Natural Resources and Food Security Through An HIV/AIDS Lens: Lessons From the Agincourt Health and Demographic Surveillance Site in Rural South Africa

Presenter: Lori Hunter, University of Colorado at Boulder, United States

Authors: Lori M. Hunter (1), Laura Patterson (1), Wayne Twine (2)

University of Colorado at Boulder, Boulder, CO, United States (1), University of the Witwatersrand, Johannesburg, South Africa (2)

Two important trends in population and the environment are presently colliding to shape the sustainability of rural livelihoods in many poor nations: 1) increases in adult mortality due to the HIV/AIDS pandemic, and 2) declines in the availability of proximate natural resources. Taken together, these trends pose severe threats to rural livelihoods. Yet the environmental dimensions of the HIV/AIDS pandemic have received little scholarly attention. Demographic surveillance data from rural South Africa are used here to examine the hypothesis that HIV/AIDS mortality represents a unique form of household shock. We also examine the role of the natural environment in mortality-related coping strategies. Using food security as an outcome, we empirically model (1) food insecurity, (2) dependence on homestead gardens, and (3) dependence upon local vegetation and meat sources. Results indicate that HIV/AIDS mortality-affected households do not differ significantly from those households experiencing non-HIV/AIDS-related prime-age adult mortality on the outcome variables. However, households impacted by prime aged adult mortality from all causes are significantly worse off on many of these measures, as compared to their non-mortality counterparts. These findings question the contention that HIV/AIDS-related mortality is a distinct household shock, although the disease is nearly doubling the adult mortality rate in this study context. In this way, HIV/AIDS poses a significant threat to food security and may intensify natural resource pressure through increasing adult mortality more generally. Conservation and public health policy implications are explored.

Relationships between livestock production, demographic change and natural resources in Africa

Presenter: Jeannette van de Steeg, ILRI, Kenya

Authors: Jeannette van de Steeg (1), Mario Herrero (1), Paulo van Breugel (1)

ILRI, Nairobi, Kenya (1)

In the last years livestock research for development has been based on the concept that the demand for livestock products is increasing. This has often been referred to as the livestock revolution. Like in Europe and Asia, in Africa the local and regional demand for livestock products will increase as a result of growing populations and urbanization. To meet this increasing demand, an increase in livestock numbers and productivity per animal is needed. This study examines the development of livestock systems over time and across countries and relates this to demographic developments. This leads to a better understanding of food security and the role of animal production in consumption patterns. In addition to that, the environmental implications of the increases in animal production were studied.

This research effort shows that the population growth rates in Africa are indeed among the highest in the world, and urbanization is taking place rapidly. As expected, also the livestock production is increasing. However, this increase in production can only be attributed to an increase in livestock numbers, not in animal productivity. In some countries the livestock units per capita are even decreasing. The increase in livestock numbers has far reaching consequences on the preservation of ecosystems, land replacement and depletion, and usage of scarce water resources. By gaining a better understanding of livestock developments and consequences on food security and environmental degradation, it is possible to better target investments in livestock production to help alleviate poverty in Africa.

Surface modelling of population density and food provision capacity of ecosystems in China

Presenter: Tian-Xiang Yue, Chinese Academy of Sciences, China

Authors: Tian-Xiang Yue (1), Ji-Yuan Liu (1)

Institute of Geographical Sciences and Natural Resources Research, Beijing, China (1)

A method of surface modelling is developed for simulating food provision capacity of cropland, grassland, woodland and aquatic ecosystems. Based on this method, human carrying capacity is calculated, which provides an upper limit of population that could be supported by the food provision services of terrestrial ecosystems in China. Then, trends and scenarios of food production in terms of calories, protein and fat in the middle of this century in China are evaluated under consideration of effects of climate change, land use change, Grain for Green program, south-to-north water division project, fisheries catches along Chinese coast, and the importing and exporting of food. Surface modelling of population distribution is conducted on datasets of net primary productivity, elevation, city size and distribution, and transport infrastructure distribution of China by means of grid generation method. Three scenarios of population distribution in the middle of this century are developed on the basis of projecting population size by constructing population growth model. Finally, balance between food provision capacity of ecosystems and population density are analysed and response options are proposed for food security.

Land demand of food in the Philippines over the 20th century: non-linearities in the face of continuous population growth

Presenter: Thomas Kastner, University of Groningen, Netherlands

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Center for Energy and Environmental Studies, University of Groningen, Groningen, Netherlands (1)

Provision of food is the central ecosystem service. We investigate how land demand for food develops as populations grow, diets change and resources are limited. The Philippines provide an excellent case: over the 20th century population grew 10-fold implying similar increases in basic dietary needs.

To quantify occurring changes, we link average per capita dietary patterns to their actual land requirements. For this, we utilize data on food consumption, crop yields, livestock, and agricultural trade for the Philippines from 1910 to 2003.



While average food supply per capita improved over the century, land requirements declined, albeit not continuous: they were 2,200 m² per person in 1910, 2,000 m² in 1961, 1,100 m² in 1985 and 1,000 m² in 2000. Accounting for population growth, this translates to a 4-fold increase in land needed for food from 1910 to 2003.

Over the first half of the century, increased food demand, deforestation and expansion of cultivated areas were closely linked. When limits of permanently cultivatable lands were reached, agricultural intensification allowed to feed more people from the same amount of land, at the cost of ever-increasing external inputs. Recent increases in total land demand for food could not be met by domestic production, which turned the nation - a traditional exporter of tropical cash crops - into a net importer of food.

Our study provides an example that continuous population growth is often linked to non-linear changes in resource demands. When discussing future development paths, such non-linearities have to be addressed.