Institutional Challenges to Robustness of Flood Plain Agricultural Systems

by

Audun Sandberg

Bodø University College, Norway

Summary:

The farming of natural flood plains was in many parts of the world the cradle of civilization. The Nile Valley, the Indus Valley and Mesopotamia supported high cultures with complex social structures. These gradually harnessed and changed their own environment into what we often call a Constructed Social-Ecological System – or irrigation systems. The distinct path of development from natural risky flood plain systems to socially controlled environments was in each case the result of an intricate interplay between geo-politics, demography, religion, social organisation and the science and technology of the time. In some cases the transition was caused by collapse, in other cases facilitated by demographic success or political supremacy of invading groups. Thus it is difficult to make generalisations beyond time and place with respect to the robustness of these past systems for risk management and the influence of institutional arrangements.

Today there are very few natural flood plains left to study in the warm regions of the world. One such flood plain is the Rufiji Flood Plain in Tanzania, on East Africa’s largest river. Here there has not evolved an artificial irrigation culture, but a robust risk minimising flood plain agricultural system based on staples like rice, maize and peas, and more recently on cotton and fruits. All through the Arab, German and British colonization, various attempts has been made to “modernise” this agricultural system, the result of which was only that new crops and varieties were incorporated into the system in order to make it even more robust.

This study starts with the first challenge to this agricultural system; the removal of the population from their dwellings in the flood plain to “safe ujamaa villages” on higher ground in the 1970s. It compares this with the institutional challenges 30 years later when structural adjustment policies, individualized tenure, land “grabbing”, infrastructure development and urban food marked expansion alter fundamental property rights to land and change individual farming strategies. These challenges are considered to be of a more profound character, and more likely to affect the inherent robustness of this flood plain agricultural system than previous ones.

However, the key question of what it takes to transform this flood plain system into a controlled social-ecological system is not answered here, it lies somewhere in the haze of future collective actions.
The study of “Robustness of Social-Ecological Systems” often requires lengthy observations. The processes of nature; the formation, the maintenance and the decay of eco-cycles, are slow processes that may take many generations to work their way through the system. Likewise the processes of human society, the changes in inherited institutions and cultural legacy, are usually incremental and invisible to the “one-shot” research project. However, the decisions on how to alter policies, incentive structures and basic institutions like property rights, are often based on such short-term observations. They are thus often threatening the long-term robustness of the interaction of the ecosystem and the social systems governing the human use of these. If for example one disaster flood prompts the removal of peasants from their dwellings in the flood plain, this can have long term repercussions on the robustness of agricultural systems as a whole and on the ability of peasants to exercise “Ecology Control” in relation to the wilderness (Kjekshus 1977 & 1996).

The flood plains of the world have widely different stories to tell about the long term robustness of Social-Ecological Systems. The long enduring systems of the Nile Valley, the Mesopotamia and the Indus Valley were in most respects “Cradles of Civilization”, thus their basic Social-Ecological Systems must have been fairly robust. The explanations of the ecological success and failures of these systems are multiple, they range from the biblical narratives of Paradise on Earth, to the more cynical explanations of population pressure as a precondition for agricultural growth (Boserup 1965). Already Karl Marx classified the “Asiatic mode of production” as one based on state-controlled irrigation and a system of royal despotism and ownership of all land. But in contradiction to the whole Marxist programme for explaining the evolution of “western” modes of production, he offers hardly any explanation of the dynamics of change in this kind of class society: How did the transition from “natural” flood plain agriculture to controlled irrigation take place, how was the “surplus” that formed the basis for “civilization” appropriated and what were the seeds of change and decay of these great systems. To some theoreticians, a strong central power, an oriental despot who combined religious and political powers, has been seen as a precondition for a transition from a risk prone flood agriculture to a “hydraulic society” - a controlled irrigation farming system, (Wittfogel 1957). To other theoreticians, a despot might have been useful in organising defence against foreign invaders, but the transition itself is taken care of by the peasants themselves through continuous intensification and refinement of the farming system in response to a rising population (Geertz 1963).

The temptations to make sweeping generalisations about the evolutionary forces built into Social-Ecological Systems will always be present. Therefore it is important to warn against overgeneralizations beyond time and space or beyond particular technologies and particular ecologies: The risk prone flood agriculture of the Nile Valley did in the millennia before the erection of the Aswan Dam produce a considerable surplus that was transformed into high cultures, religious belief systems, generous art and advanced science. While the humanly controlled irrigation system of the Indus Valley decayed and produced a salinated and eroded environment that resembled the land given to Adam and Eve after expulsion from the Garden of Eden. Each of these farming systems, from the Nile Valley to the terraces of Java, have their distinct genesis. This means that the system; the planting cycles and planting strategies, the choice of crops and tilling methods have evolved as an intricate mix of power relations, belief systems, available technologies and market access. When certain ways of doing things have proved to be useful, this often becomes the “common way”. It both saves time, minimise social transaction costs and reduce risk (or at least the social blame for failure) to adhere to the “common way”. Thus working rules and organisations are often tailored to suit these ways, and institutions like incentive structures and property right systems evolve and become
codified as frozen images of the “ways we used to do things”. The “path-dependency” of institutional development therefore explains a large portion of the inertia found in agricultural systems at the same time as it explains the preference for some predictability in a basically unpredictable ecology facing any natural resource based social system (North 1990). And the same path-dependency also explain why sweeping generalisations are risky, every Social-Ecological System, every Asiatic or African mode of production have their own genealogy and must be analysed on their own merits.

Flood Plains are extreme cases of risky environments. In ecologies without human control over stored water, the absence of floods usually spells draught and disaster for large populations. Likewise, a peak flood that sweeps away everything that is planted in both low places and high places also lead to crop failure and famine. To ensure that nature delivers a “good” medium flood with nourishing silt every year has so far been beyond the control of any social system. The social solution is advanced micro-adaptation to the highly variable effects of the flood, both its variations across time (from one year to the next) and across place (between elevations). The opposite alternative to evolving adaptation is massive flood control works, i.e. the total removal of floods, the storage of water and silt, and the overall replacement of flood-plain agriculture with irrigated agriculture. Any in-between design seems less workable. For most large flood plains massive flood control works seems unlikely to grow from peasant initiatives, they require the organising capacity and the resources of an “oriental despot”, a strong (benevolent or predatory) state or a wealthy donor. For smaller flood plains, peasant co-operation in harnessing the water and constructing a socially controlled ecological system seems feasible, although it will always depend on the existing property rights distribution, on the social capital in the communities involved and on the commitment to the local organisation.

Most flood-plains of the temperate or tropic world are already transformed into socially controlled ecological systems – or irrigation systems. This makes it difficult to answer the big underlying question: What does it take to make this transformation from a naturally flooded environment into a controlled environment? What are the social and technological preconditions that must be in place and what are the typical obstacles? And what are favourable institutional arrangements that can facilitate such a transformation? Here it is important to bear in mind that these great transformations has happened over several millennia, with large differences in level of hydraulic and farming technology, with large differences in crop availability and crop genetics. Although this is often disputed, there has also been some advances in organisational knowledge and capacity during the last 5000 years. What it took to carry through a transformation in 2500 B.C. might be very different from what it takes to initiate such a transformation in 2004 A.D. But at the same time the past transformations has to a large extent shaped the present so that the knowledge, the cultures and the institutions of the early hydraulic societies are very much part of the heritage of today’s civilizations.

The underlying question therefore becomes much more complex than a simple question of efficient Social and Ecological Interrelations. It could thus be rephrased into two different questions:

- What were the driving forces behind the great transformations of precarious flood plain agricultural systems into managed irrigation systems?
- What does it take today to transform a flood plain agricultural system into an ecologically controlled system?
The first question is one of the grand themes that have occupied economic historians and sociologists for centuries. As mentioned above, several of the great theorists of classical social science have been intrigued by such revolutions in the basic mode of production and have tried to design grand theories that could explain all past—and future transformations. Not only Marx, Wittfogel and Geertz designed comprehensive theories, but also Max Weber and Douglass North have made attempts to explain the driving forces in such dramatic shifts as a strive for rationalization and reduced transaction costs.

The second question indicates that such grand theories will always be futile, the driving forces in Mesopotamia, Indus Valley and Egypt must be understood in their own time and ecology and cannot be generalised across time and place. What it takes today to carry through a transformation might be very different from the time of the Mesopotamian rulers. In our globalized world it might more probably take a favourable feasibility report to the World Bank rather than a conducive political and institutional framework on the ground.

In this paper we shall therefore aim for no more than testing “middle range theories” in answering this underlying question of what it would take today to transform a risk prone flood plain agricultural system into a socially controlled ecosystem? And further we shall see what we can learn from such probes in terms of relationships between Social Systems and Ecological systems.

One of the few remaining large natural flood plains in the world is the Rufiji River Flood Plain in Tanzania. While most large flood plains of the temperate and tropical zones have been harnessed and turned into irrigation schemes, the flood plain and delta of this largest of the East African Rivers remains naturally inundated by yearly floods and fertilized by annual deposits of silt. A number of potential candidates offer themselves as explanations of the absence of a transformation of this un-harnessed Ecological System. Most of these are related to the way of farming and living in the flood plain as individual and collective solutions to the risks of a flood environment. As such they constitute a social system for managing ecological uncertainty and reaping possible, but unpredictable benefits.

**The Rufiji Delta Agriculture as a Risk Management System.**

A considerable rural population is still dependent on the generous gifts and the fatal risks of the river and has through the centuries developed an intricate farming system that attempts to reap the benefits at the same time as it guards against the risks. This system has been described through the last 4 centuries and shows a versatile capacity to incorporate new crops and new farming technologies (Bernadino 1962), Marsland (1938), Sandberg (1974). Approximately 150,000 people, mostly peasants, inhabit and farm the flooded plains and adjacent hills. This Ecological system can be divided into 9 agro-economic zones, each with its own peculiarities: The West Valley, The Flood Plain North, The Flood Plain South, The Inner delta North, The Inner Delta South, The Delta North, The Delta South – together with the upland ecologies of The North Hill and The South Hill.

Most floods will be most severe in the narrow entrance to the flood plain, The West Valley, then spread out and calm down throughout the flood plain proper and the inner delta. When a flood meets the tidal effect of the delta, its effects are largely offset by this. Even a high
volume flood will in most years be offset by the combined system of distributaries and tidal effect of the delta, while an early high peak flash flood can cause considerable damage also here. On the other hand a flood has to be of a considerable height and volume in order to inundate the heavy alluvial soils of the flood plain and to flush out and keep at bay the salinity resulting from the tidal action. Only with yearly flushing can cultivation of the delta continue, otherwise the mangrove forest will expand inwards towards the inner delta. The rainfall also varies considerably, from 1000 mm/ year in the Delta to 600 mm/ year in the West Valley, thus offering the best opportunities for rain fed farming in areas where the floods make the least damage.

The third factor affecting risk management in the agricultural system here are the varied soil conditions and micro-differences in elevations in the flood plain. These are largely a result of thousands of years of flood and tide action and of differential silting. These alluvial processes lead to a very complex micro-ecology; river courses change continuously while old river levees and ox-bow lakes are left behind. Even old storm beaches in the delta are part of this complexity. The lowest parts of the flood plain have largely clay soils, Kitope, which have high soil moisture retention capacity, poor drainage and are hard to work with hand tools. The most preferred soils, the Mbaragiwa soils, are found at medium elevations in the flood plain, on old river levees and other areas that are normally lightly flooded. These are mixed clay and sand soils, have good water retention capacity, good drainage and are easy to work with hand tools. The Gongo soils are found on the highest river levees not flooded during a “normal” flood. These are mostly sandy soils, the have a low water retention capacity, good drainage and they are easy to work with hand tools. But in addition to these 3 major ecosystem properties, farmers also view the ecosystem in a 3-dimensional and dynamic perspective. They distinguish between uniform alluvial clay and clay overlying mbaragilwa or sand, as well as between uniform mbaragilwa and mbaragilwa overlying sand or clay. In a dynamic perspective, the users of the preferred mbaragilwa soils, there ought to be a substantial flood with considerable silt deposit every third year. If this does not happen, the yield will drop to about one half without the application of artificial fertilizers (Sandberg 1974, Havnevik 1993).

In this risky and generous environment, it has evolved among the peasants of Rufiji an intricate agricultural system that seems to minimise risks and maximise benefits as far as possible. The system has evolved from below, not only as response to the ecological factors mentioned above, but also as a response to colonial and state intervention in rural production, technological and marketing possibilities. There is a long discussion whether the system has once been at “its peak” and then decayed due to modern influence (Marsland 1938, Kjekshus 1977/96, Sandberg 1974, Havnevik 1993). To most farmers, however, the “system” means little; it is the farming strategies open to them that produce their individual and collective choices and thus reproduce what can be observed as a system. Therefore the evolutionary history of the agricultural system is not so interesting in this perspective, apart from the path-dependency the ways of doing things in the past creates for future generations. The question is rather, with 9 agro-economic zones, 8-10 different crops, 3x3 soil variations and elevations, should there not be sufficient strategies available for any farmer to meet any flood scenario? And why should this Flood Plain Agricultural system then not constitute a “Robust” Social-Ecological System with no need for transformation into an irrigated Ecological System? To answer these questions, it is necessary to look more in detail at the agricultural system, here as it was practiced in the second half of the 20th century.

Conveniently the Rufiji agricultural system can be seen as consisting of two subsystems: the older Mlau-system – or the dry season farming system (June – September), and the newer Mvuli – system – the flood season farming system (February to June). The Mlau system is a
low-risk system, a flood recession planting strategy where the roots of the growing plants follow the sinking moisture level and all parameters (flood heights, duration and soil properties) are known at the time of planting. The Mvuli system is a high-risk system where the properties of the coming flood are unknown and where the farmers should prepare for alternative flood scenarios by planting at different elevations. The typical farmers’ calendar would thus look like this for a farmer who tries to implement the entire system:

<table>
<thead>
<tr>
<th>Month</th>
<th>Low water</th>
<th>Plant Maize on high river banks</th>
<th>Good crop if low flood</th>
</tr>
</thead>
<tbody>
<tr>
<td>November</td>
<td>Low water</td>
<td>Start preparing rice fields</td>
<td>Avoid labour bottlenecks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Harvest and market cotton</td>
<td>Mlau system</td>
</tr>
<tr>
<td>December</td>
<td>Low water</td>
<td>Harvest and market mango fruits</td>
<td></td>
</tr>
<tr>
<td>January</td>
<td>Low water</td>
<td>Harvest maize from low clays</td>
<td>Mlau system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Preparing rice fields continue</td>
<td>Avoid labour bottlenecks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plant Maize on high river banks</td>
<td>Good crop if low flood</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Harvest and market mango fruits</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>Low water</td>
<td>Plant Rice, fast/slow &gt; high/low</td>
<td>Right variety in right place</td>
</tr>
<tr>
<td>March</td>
<td>Rising water</td>
<td>Rice is growing</td>
<td>Good crop if medium flood</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Harveset maize from river banks</td>
<td>Needs dry spells to ripen</td>
</tr>
<tr>
<td>April</td>
<td>Flood peaks</td>
<td>Rice grows</td>
<td>Tolerates medium floods</td>
</tr>
<tr>
<td>May</td>
<td>Flood recedes</td>
<td>Rice ripens</td>
<td>As flood recedes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plant maize on highest places</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plant Cowpeas on highest places</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>Flood recedes</td>
<td>Plant maize on Mbaragilwa</td>
<td>As flood recedes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plant Cotton on Kitope</td>
<td>As flood recedes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Harvest Rice</td>
<td>Labour peaks</td>
</tr>
<tr>
<td>July</td>
<td>Flood recedes</td>
<td>Harvest and market rice</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plant Cotton on lowest clays</td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>Low water</td>
<td>Harvest maize from high places</td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>Lowe water</td>
<td>Plant maize on lowest clays</td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>Low water</td>
<td>Harvest Cow -peas</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Start harvesting Cotton</td>
<td></td>
</tr>
</tbody>
</table>

Within the given Ecological system, this constitutes a sophisticated system of allocation of human resources throughout the year. Although it is virtually impossible for every peasant to use the whole system within one year, it is important to think of it as a set of collective strategies at their disposal, in short it is part of the Rufiji peasant culture. Although probably not an optimal system in terms of output per man-hour spent in farming, the system is robust in face of the risks involved in flood farming. This robustness also comes from the flexibility of the system, if disturbed by absence of rain or devastating floods, the system I self-rectifying within the same agricultural year. If a high and voluminous flood drowns all the rice in April, there are no labour peaks in June, but large areas of moist and fertile soils that can be planted with cotton, maize and cow -peas. Such large floods have on average happened every 6th year during the last century, e.g. in 1930, 1936, 1940, 1942, 1944, 1945, 1952, 1956, 1962, 1968, 1974, 1979 etc. (Havnevik 1993) If the flood is medium or small, the rice yield is usually good provided that the right rice variety has been planted in the right micro-environments (Sandberg 1974). Now there are neither vast areas, nor many free hands available to plant large quantities of cotton and maize.
As explained above, the Rufiji Flood Plain Agricultural System can be seen as a fully evolved risk-minimizing system where the farmers absorb all the risk themselves. As such it is a Robust Social-Ecological System capable of accommodating most environmental uncertainties. The farmers of Rufiji have also shown a rare capacity to include new crops and new technologies into their strategic repertoire: Rice during the Zanzibar Sultanate, Maize from South America, Cotton during the German Colonial Period, Cashew nuts, Oranges and Mangoes, all these crops were incorporated into the agricultural system in a way that strengthened the system and made it more robust as a risk management system. But as it takes a lot of human concern and effort to prepare for several possible, but unknown future flood situations, the return to labour will always be low in such a system. It takes a lot of extra work to have more than one egg in your basket. Low labour productivity is therefore the price the Rufiji peasants have to pay for their complicated risk insurance system. Faced with modern market forces, both in crop markets, capital markets, labour markets and property markets, this low labour productivity represents a new kind of risk which became more pronounced towards the end of the 20th century and the beginning of the 21st century. If risks are likely to be absorbed by others than the peasants, e.g. financial markets, farming strategies with higher labour productivity will most probably win over the traditional ones.

Also, the continued robustness of the agricultural system itself depends on a number of conditions that have to be fulfilled. They are mostly related to the micro-environmental knowledge among the peasant population and especially the dynamic aspects of this.

- Shared knowledge of diversity of flood heights and onset times in various fields
- Shared knowledge of drainage and fertility properties of the various soils
- Shared knowledge of place and timing of vermin attacks
- Shared knowledge of the flood resistance properties of seed varieties (rice)
- Shared knowledge about the importance of land tenure mechanisms which allow most farmers to make the right strategic choice in relation to time and place for planting and use of human energy.

If these preconditions are not fulfilled – i.e. actively maintained and supported, this will affect the long term robustness – or sustainability - of such a system. Conditions from which such robustness is likely to be affected is e.g. in the case of a breakdown of effective transmission of knowledge between generations, in the case of state intervention in rural production and marketing, and in the case of land tenure changes initiated without the participation of the peasants. Recent developments in Tanzania show a number of examples of cases which have negative impact on the robustness of intricate risk management systems like the Rufiji Flood Plain agriculture. We shall briefly deal with some of these below.

**Ecology Control Initiatives**

The first State effort to modify the Agricultural System of the Rufiji Flood Plain was the forced cultivation of cotton introduced by the German colonial Government in 1902. It threatened and interfered with the traditional rice and maize system evolved during the Zanzibar Sultanate and led to the largest peasant uprising in Colonial Africa, the Maji Maji rebellion (1905-1907) where altogether 75,000 Africans were killed. However, after the rebellion, the Rufiji peasants adopted the cotton as a cash crop and planted large areas with cotton under their own control, especially when the Germans established ginneries and efficient market outlets for the crop (Havnevik 1993). But new crops were not always the result of state initiatives. Apart from a massive cashew nut campaign, most new crops were
adopted gradually without any campaigns and incorporated into the agricultural system explained above so as to transform this into a more intricate Social-Ecological system.

After a devastating flood in 1968, the Tanzanian Government decided to alter the Social-Ecological system of the Rufiji dramatically. Future disaster prevention and the ideological aim of Ujamaa (living and working together) were blended to produce the first ujamaa-campaign in Tanzania 1968-1972. This removed the majority of the peasants from their dwellings in the flood plain and relocated them in secure villages on higher ground. By 1973, 75% of the population in Rufiji were living in 25 ujamaa villages, the remaining 25% were either not affected by the operation (the Delta) or refused to move because the proposed villages were too far from their fields. In the West Valley the peasants lost most of the control over their fields, as the new villages were established on the north side of the Rufiji River while their field in the valley remained on the south side of the river, now bordering the Seleous Game Reserve directly. Without any human settlement as a barrier against wild animals, the attacks on crops by elephants and wild pigs added new risks to the difficulties of farming in this part of the flood plain (Sandberg 1974). In the Flood plain North the distance to the flood plain fields were short, here the peasants in the new villages could continue the agricultural system explained above more or less uninterrupted after 1973. But gradual urbanization of these villages, especially Ikwiriri, now a town of 40,000 inhabitants, has increased the value of good flood plain land, thus altering the strategic options for farmers. Here is also a new bridge (2003) across the flood plain and river, which dramatically increases the marketing possibilities for all crops from the whole of the Rufiji Flood plain. In the Flood Plain South and in other parts of Rufiji, villagers were reported to maintain the system somewhat throughout the 1980s and 90s by establishing peripheral houses in their old fields, thus commuting between the new villages and the flood plain (Havnevik 1993). Thus the resettlement of farmers from the flood plain to higher ground villages has not destroyed the Social-Ecological System evolved in the Rufiji, but has in a dramatic way brought the farmers more into the mainstream of national development.

Attempts have also been made to change the Ecological System of Rufiji itself in the shape of plans for a large Dam at Stiegler’s Gorge for the combined purpose of Hydro-electric Power production and flood control. Already in 1907 the Germans (Stiegler) surveyed the Rufiji Basin for the potential for irrigated agriculture and hydropower generation. Surveys both in 1928, 1952 and 1961 (FAO) were based on the multipurpose idea of replacing the flood agriculture of Rufiji with an artificial irrigated agriculture combined with absolute flood control and hydropower production. The FAO report concluded that the cost to each acre of net irrigable land (flood control and irrigation) would be rather high, and that more than half of the costs therefore should be charged to hydropower generation. Subsequent surveys in 1967 (USAID), 1968 (JETRO), 1972 (NORAD/Norconsult), 1980 (NORAD/Hafslund) therefore put most emphasis on the hydropower generation potential. Gradually the criticism against this single purpose planning strategy grew and a multipurpose approach was reintroduced. But contrary to the early German ideas of a massive transition from flood cultivation to artificial irrigation, this approach was a modified flood release design, which aimed at not loosing too much electricity, while releasing sufficient floods through low level outlets to allow the flood plain agriculture to continue during a lengthy transition period towards fully irrigated agriculture. This transition was however not part of the project. The multipurpose compromise was therefore a poor one, so that the feasibility of both the hydropower objectives and the agricultural objectives were only marginal. Finally, the World Bank turned down the project; only a proper plan for a comprehensive multipurpose project would stand a chance at the World Bank. There might be many explanations offered for this
distinct non-transition to irrigated agriculture during the whole of the 20th century, among them the role of donors, consultants and sector bureaucrats. The farmers of Rufiji have, however, been absent in the entire discussion of a possible total change of this Social-Ecological system. Will they be part of the process when the issue of flood control, power generation and irrigated agriculture appear again in the 21st century?

**Land tenure changes and modernization of the Social System**

The struggle of the Warufiji during colonial times taught them the lesson that their land in the flood plain was valuable and worth fighting for. In the traditional settlement pattern, the fields were organised around the homestead, with individual family members, including wives and in-laws being allocated their own plot for the growing season by the family head. These patterns we could still find in the inner delta in the 1970s. A typical homestead here consisted of 21 people farming about 4 hectares continuously. The micro-ecology of the area decided to a large extent which crops could be grown in what place, and the working ability of the individual decided to a large extent the size of a particular plot (Sandberg 1974)

During the ujamaa programme, the state launched a campaign for collective farming. However, the peasants had bad experience with the co-operative farms of the corrupt and defunct Co-operative Society and did not see collective farming as a novelty. The solution was that communal farms were demarcated on the infertile and sandy higher grounds close to the new ujamaa villages, while the land tenure of the fertile flood plain was left alone. As no annual crops would succeed on the higher ground, they were planted with cassava and cashew-nut trees, which, if tended properly, can give a considerable cash income. Thus the effects of the period of collectivisation in Tanzanian agriculture was hardly noticeable in the flood plain agriculture. But the effect of the movement of people to ujamaa villages has gradually become more noticeable. As the demographic processes of aging, marriages and birth work their way into land use, the tenure in practice gradually become more and more fragmented. One person can have different plots through different family affiliations in widely different places. The advantage of this is that risks are low if these plots are in different micro-environments. The disadvantage is that labour productivity in tilling, planting and harvesting is even lower than before, due to the need for extensive commuting between the village and the various plots. Also the institutions for allocation of plots to new members of villages (youngsters, married or migrants) come under pressure when fragmentation becomes too intricate and the Customary Village land property rights might erode from within. Some effects of more cumbersome land tenure arrangements can bee seen in the increasing number of young men engaging in “bizzniss”, like charcoal trade, hardwood logging, fruit sales (mango) to urban markets in Dar es Salaam etc. Most probably these give higher return to labour than continued farming in the flood plain.

Under pressure from the World Bank for “structural adjustments”, Tanzania did during the 80’s embark on a road “from Ujamaa to economic liberalization”. As part of this, a New Agricultural Policy was formulated, which opened up for institutionalising a market for land – also in rural areas. A long struggle took place during the 1990s over the question whether Village Land property rights should be codified in new legislation (The National Land Policy 1995), or whether it should only be protected administratively without any title, but with freedom to enter into land transactions also for villagers (Draft Bill for the Land Act 1996)(
Izumi 1998) Finally, and still under pressure from the World Bank, a land act which established a sort of market for agricultural land was passed. This will enable villagers to buy land and get a title, but it will also enable foreign investors and political dignitaries to buy large tracts of land for commercial agricultural production. So-called “land-grabbing”, i.e. the conversion of political capital into individual land property will now be legally possible under the new act. Exchange of political favours towards special villages against individualization of village land is only one way of making such conversions.

The Rufiji Flood Plain is a very attractive tropical agricultural area, and both rich villagers in Rufiji, foreign food companies and national industrial and political leaders will be interested in acquiring individual property rights in this area. The new bridge has also “opened up” the vast area of flood plain south of the river for non-subsistence agricultural development. In addition is the rapid growth of the capital Dar es Salaam (from 0.75 mill in 1974 to 3.5 million in 2003) an enormous impetus for accelerated commercialisation of agriculture in the Rufiji Flood Plain. The first cases of land purchases in the Flood Plain have not yet been observed, but are likely to happen in the near future.

**Implications for the Robustness of Social-Ecological Systems**

Changes in land tenure alone does not affect the robustness of a Social-Ecological System. But agricultural practices resulting from land tenure changes can influence dramatically on the robustness of a system. However, the robustness of a subsistence agricultural system and that of a commercial agricultural system is quite different. Failure of subsistence spells famine and international famine relief for large populations, failure of a commercial system spells financial burdens and bankruptcy. In the end is a question of who absorbs the risk: the hard toiling Rufiji peasant with all his labour bottlenecks – or the national banking system or multinational corporation.

The irony is that with a potential growing commercial sector in Rufiji Flood Plain agriculture, the question of transition from flood agriculture to artificial irrigation will be quite different from than it was in the 20th century. The balance of power between the State/donors and the farmers will shift in the favour of the farmers and they will have a greater say in how the future control over the Social –Ecological System shall be designed. But that is the story of the 21st century.
Bibliography:


Birgegård, Lars-Erik. 1993
Natural Resource Tenure - A review of issues and experiences with emphasis on Sub-Saharan Africa., Swedish University of Agricultural Sciences, International Rural Development Centre, Uppsal 1993

Boesen, Jannik et al. 1978


De Soto, Hernando. 2001
The mystery of Capital, Black Swan, 0552 99923 7 - Pocketutgave


Gibbon, P., Havnevik, K.J., Hermele, K. 1993

Havnevik, K.J., 1993, Tanzania, The Limits to Development from Above, Nordiska Afrikainstitutet, Uppsala

IFAD, United Republic of Tanzania - Country Strategic Opportunities Paper Executive Board 80th session 2003.

Ikdal, I., 2000, Human Rights and Rural womens land rights, an analysis of the land tenure system and the land reform in Tanzania, Undergraduate dissertation for the law degree, February 2000, University of Oslo (- Ins. For kvinnerett Univ i Oslo)

Kaori Izumi, 1998,
Economic Liberalisation and the Land question in Tanzania., Ph.d Dissertation, International Development Studies, Roskilde University, Denmark


James Curry


Okoth-Ogendo, H.W.O


United Republic of Tanzania, 1992

McAusland, 1996
A draft of a Bill for THE LAND ACT, prepared for The Ministry of Lands, Housing and Urban Development, United Republic of Tanzania, under an ODA CONTRACT.