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Competing land-use in a small island developing state: using landscape approaches to manage sustainable outcomes in the Comoro Islands

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Abstract

As for many Small Island Developing States, interdependence between people and nature is profound in the Union of the Comoros. Over 90% of the population are dependent on agriculture, population density averages over 600 people/ km^2 in Anjouan, the deforestation rate was the highest in the world between 2000 and 2010 (FAO, 2010), and 30 of 45 permanent rivers on the island of Anjouan have become intermittent. Efforts to develop natural resource management are complicated by the extremely low institutional capacity at all levels.

Since 2008, the local NGO Dahari (meaning 'sustainable': www.daharicomores.org) has been working in Anjouan to develop an innovative integrated landscape management strategy that improves rural livelihoods whilst conserving remaining natural resources and endemic biodiversity. The NGO has supported over 2500 farmers to recreate fertility and increase productivity in lowland fields – thus reducing agricultural pressure on upland forest areas – improving the implementation of existing agro-ecological techniques and introducing new techniques that have shown results in the region. With productivity increased, the NGO is now exploring opportunities to improve access to market through exportation to the other islands of the archipelago, and to improve revenues from cash crops.

Following testing of different modes of collective management and a series of ecological and social research activities, natural resource management initiatives based on the presence of committed local leaders are focusing on small areas that can be used as examples for expansion. The first ever zones of protected forest for the country are now being mapped out, targeting the preservation of diminishing water resources, and a system of payment for ecosystem services is being implemented to conserve key biodiversity areas in a way that benefits local landowners. A strategic plan for 2015 to 2020 lays the pathway to expanding the NGO's impact to the national level.

Keywords: Comoros, SIDS, Agro-ecology, Landscape Management, Forest, Conservation

Introduction, scope and main objectives

Although Small Island Developing States (SIDS) face many of the general challenges of developing countries, they are recognized as sharing specific characteristics that increase both the complexity and severity of these problems. Various global assessments (eg. UN 2005) highlight in particular their limited natural resources under pressure from high population densities, low institutional capacity, dependence on international trade despite high costs and difficulty in accessing markets owing to their isolation, and greater vulnerability to climate change owing to concentration of people and economic activities in coastal zones. Interdependence between people and nature is often profound.

These challenges are evident in the Comoros archipelago in the Western Indian Ocean, among the very poorest countries in the world (UNDP 2014), and especially in Anjouan, the poorest and mostly densely populated island. There are approximately 275,000 people living on Anjouan, over 90% of whom are dependent on agriculture; population density averages over 600 people/ km^2 and continues to rise; the deforestation rate was the highest in the world between 2000 and 2010 (FAO, 2010), and about 30 of 45 formerly permanent rivers on the island have become intermittent in the forty years since decolonization (ECDD 2012). Efforts to develop natural resource management are complicated by very low institutional capacity at all levels.

There are two factors that differentiate the Comoros and particularly Anjouan from many other SIDS. Firstly, rather than being low-lying, the islands are composed of extremely steep volcanic slopes. Heavy deforestation has therefore also led to severe erosion, resulting in topsoil loss and silting of coastal reefs. Secondly, the island of Mayotte, 60km from Anjouan, remained under the control of France at independence in 1975 and became the 101st department of France in 2012 (although sovereignty is still contested by the Comorian government). Because of heavy French investment, Mayotte has become a magnet for impoverished Comorians who risk their lives to enter Mayotte illegally.

Since 2013 the Comorian NGO Dahari ('Sustainable': www.daharicomores.org) which grew out of the project Engagement Communautaire pour le Développement Durable (ECDD: www.ecddcomoros.org 2008-13), has been working to shape sustainable and productive landscapes with Comorian communities. The NGO has core interventions covering rural development, terrestrial natural resource management and biodiversity conservation.

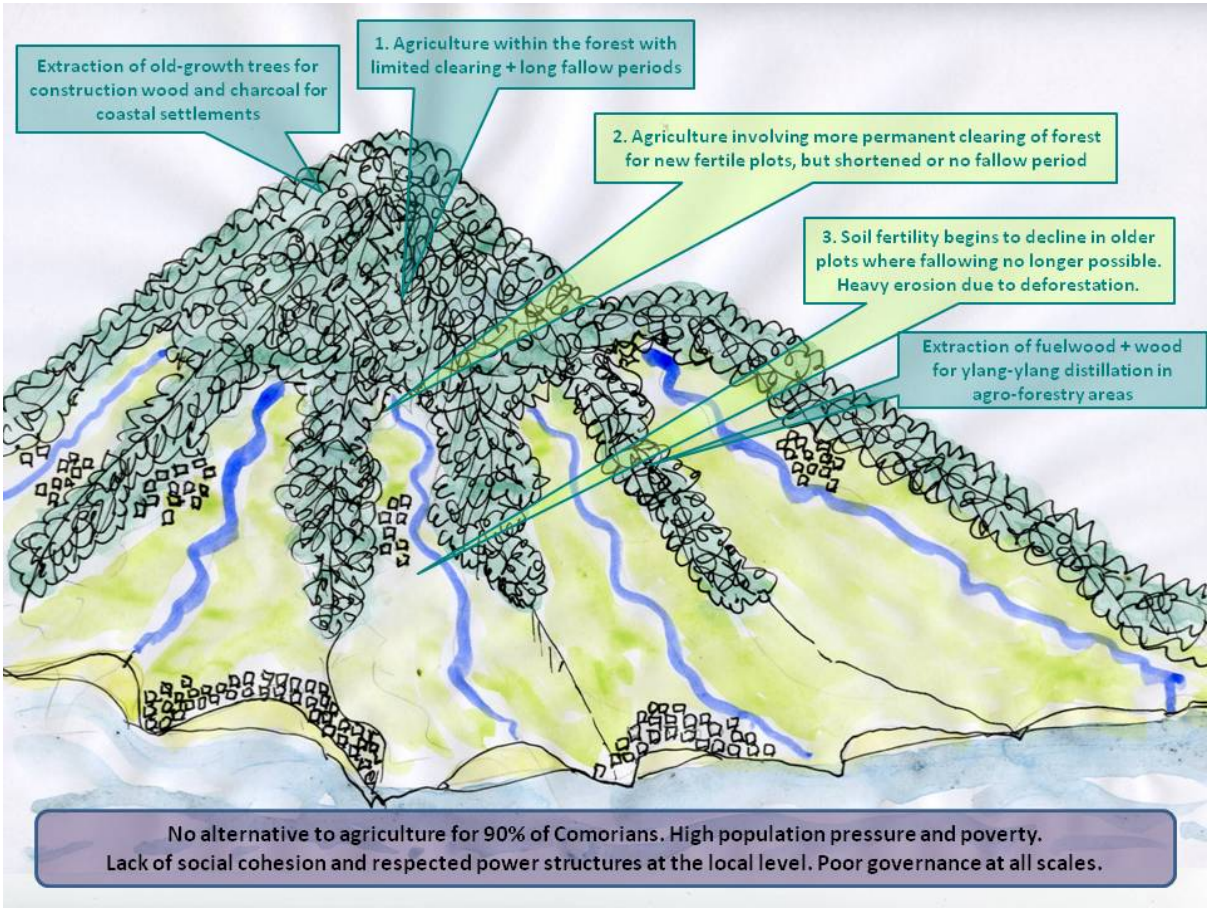

Figure 1. The problems leading to deforestation in Anjouan.

The overall aim of Dahari's work is twofold: to improve the economic conditions of rural Comorians whilst protecting the remaining natural resources and endemic biodiversity. Dahari is attempting to break the vicious cycle of poverty and natural resource degradation illustrated in Figure 1. Agriculture is largely extensive (Figure 2), with techniques often ill-adapted to conserving soil fertility on the steep slopes, thus pushing farmers further up the mountains to cut new fertile fields. Natural resource management efforts are complicated by the breakdown of social cohesion and traditional governance structures at the village level, as well as by weak state capacity.

From the start, Dahari's interventions have attempted to tackle these problems as an interdependent whole through the adoption of an integrated landscape management approach.

Figure 2. Typical fields in Anjouan: a tethered cow amidst banana plants lower down the slopes (left) and forest underplanted with bananas and taro higher up the slopes (right)

Methodology / approach

Dahari's approach to achieving its goals has been based on certain fundamental principles

1. Natural resource management in the context of economic development has been the initial priority, rather than biodiversity conservation for its own sake. Prioritizing development enabled us to gain the trust of local communities and identify ways of improving their livelihoods before looking at conservation measures which might impact negatively on livelihood opportunities.
2. Our initial participatory approach involved us ceding too much power to the communities we worked with, and we found ourselves caught in a web of manipulation and interests at the village level, often a result of previous and largely failed development interventions. Since then we continue to look to develop participatory decision-making structures, but we maintain a certain level of control to ensure that our interventions achieve their goals.
3. Previous proposals for protection of the endemic biodiversity in Anjouan, notably the flagship Livingstone's fruit bat, advocated the creation of small areas of protection (Conservation Action Plan for Livingstone's Flying Fox, 2006). From the beginning of our work we felt that long-term protection of biodiversity could only be secured if the root problems leading to natural resource degradation were tackled, a landscape scale intervention was thus chosen.
4. Our discussions with local communities led us to believe that most people were well aware of the problems they were facing because of deforestation: the loss of water resources and soil fertility were felt to be marked compared to that experienced by the previous generation. We decided that improving access to water was more likely to increase support for conservation measures than environmental education.

5. Who pays for activities depends on who benefits. Activities with individual benefit are paid for by those individuals – in contrast to several previous projects which gave out agricultural inputs for free, leading to skewed motivations for participation. The cost of collective management projects are divided between the collective beneficiaries and the NGO, with community contributions coming in kind where possible. Biodiversity conservation activities are being paid for by international conservation funders.
6. Adaptive management. Our activities and approach are constantly being appraised and re-orientated, based on our experience and the results of studies we commission or undertake.

Our theory of change (Figure 3) and these guiding principles led us to focus the majority of our work and resources during the past seven years on agriculture development, a focus that enabled us to concentrate on improving livelihoods in a way that reduced pressure on natural resources. We first worked to improve the delivery of both revenue-generating and agro-ecological techniques that had already shown results in the Comoros: market-gardening for trade, development of anti-erosion bunds and plot hedging, distributing improved food crop varieties, improving the integration of livestock management and agriculture, techniques for improving soil fertility. Training was initially delivered on an individual basis but is now given via Farmer Field Schools, with the long-term aim of developing cooperatives.

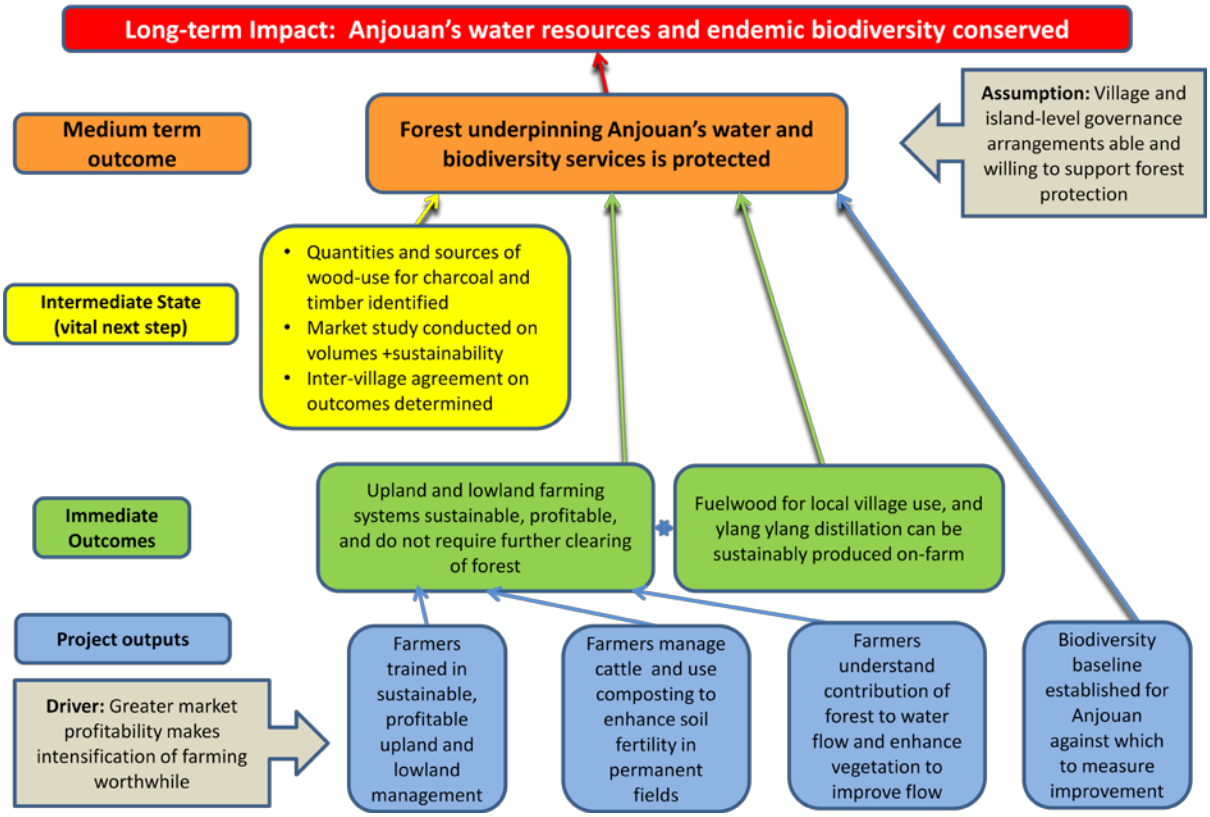

Figure 3. Theory of change supporting Dahari's current and planned interventions

From 2012, with the support of international partners – first Agronomes et Vétérinaires Sans Frontières (AVSF) and then le Centre International pour la Recherche Agronomique pour le Développement (CIRAD) – we then looked to introduce innovations to the Comoros that had proven results in the region. These include improved cattle stalls, drip irrigation, improved rotations and crop associations which follow the principles of no-till farming, improved crop varieties and better techniques for their multiplication.

On the natural resource management front, the protection of water resources was used as an entry point into wider forest management. An initial hydro-geological study that we commissioned with

AVSF identified the loss of the mist-forest in the highlands, which international studies suggest can add as much as 20% to water retention, as the proximate cause of water loss, even if the study also suggested that there was enough water still available to the population if delivery networks could be improved (Charmoille 2012).

We worked with five communities to improve the systems of pipes delivering drinking water. We also identified highland sources with potential for providing water for agriculture and developed irrigation sites. A constant challenge throughout this work has been the difficulty of identifying or creating village institutions capable of managing these type of collective projects, a result of the social structure of the villages.

On the biodiversity front the Comoros lacked basic ecological data to enable scientific identification of conservation priorities; from 2009 we therefore undertook a wide programme of forest mapping and biodiversity surveys across the three islands of the Union of the Comoros. The challenge now is to integrate this ecological data with social realities. In areas of importance for biodiversity but of less tangible importance for ecosystem services directly benefiting Comorian communities, it seems that a logical and practical approach is to develop systems of payment for ecosystem services (PES). Prioritizing the Livingstone's fruit bat, a flagship species that our studies have shown is under severe threat, we are working with farmers to develop strategies that will support biodiversity conservation in the long term, based on the understanding that opportunity costs should be met by conservation funders, including partner zoological societies holding the species.

Results

1. Agricultural development

Dahari's efforts on agricultural development are focused on improving yields in fields lower down the slopes to reduce pressure on upland areas where remaining forest is situated. The first step has been to re-establish fertility lost due to soil erosion and the failure of agricultural techniques to adapt to changes such as increased population density. Hedges and anti-erosion bunds composed of fast-growing tree species were established. The cuttings are provided as a loan with beneficiaries required to give back within two years 150% of the cuttings supplied, to be passed onto other farmers. An example of the impact on the landscape can be seen in figure 4.

Figure 4. Images from Google Earth of part of Dahari's intervention zone 17.127'S and 44° 29.712'E; 2003 (left) and 2015 (right) illustrating the impact of hedging and bunding

The rest of the agricultural support is currently focused on improving yields of food crops essential to food security - with excess sold in local markets - and improving revenues from market garden crops whilst reducing the over-use of chemical fertilizers and pesticides that impact negatively on soil fertility in the long term and leach into water supplies. Anti-erosion measures form a part of all Dahari's agricultural interventions, with farmers trained to plant across contour lines and develop

ridges to protect root crops. Integrating livestock management with agriculture is another key way of improving fertility in the long term. Those farmers with cows or goats are supported to improve their productivity through introduction of improved forage species and the installation of improved cattle stalls that capture rainwater and facilitate manure management.

Additional techniques for improving yields of food crops include the use of organic compost, and the provision of seed varieties of bananas, manioc and yam – produced in Dahari's two agricultural centres - that give both increased and faster yields. As with the tree-cuttings, the improved seed varieties have to be given back after a year to be passed on to further farmers.

Support for market-gardening comes in the form of training and the delivery of quality seeds and other agricultural inputs. A network of entrepreneurs selling agricultural inputs has been developed throughout the intervention zone, with market garden and potato seeds being imported from abroad by the NGO. The figures for the number of beneficiaries of different campaigns over the period of intervention are shown in Figure 5

Since the beginning of 2014 the agricultural revenues of a subset of 50 beneficiaries are being monitored to evaluate more closely the impact of these actions on livelihoods.

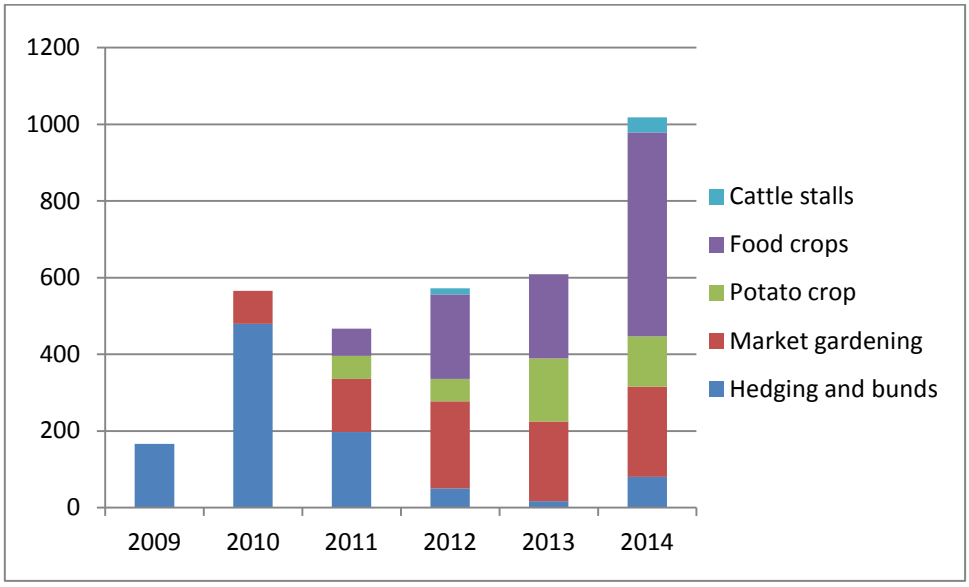

Figure 5. Number of beneficiaries of the different agricultural campaigns since the start of intervention

2. Natural resource management

Communities identified water as the key ecosystem service early on in Dahari's intervention, and conserving water supplies is a mechanism to motivate people to support natural resource management. Dahari worked initially to improve the drinking water supply to five villages whilst supporting reforestation around rivers and water collection points. Efforts then expanded to tapping upland water sources to develop agricultural irrigation. All manual work was undertaken without payment by community members, with further community contributions coming in the form of building materials and small financial contributions.

Building on the lessons learnt about the complexity of delivering collective management projects, Dahari is now focusing on supporting committed and influential individuals engaged in the long-term future of their communities to manage and reforest water catchment areas provisioning the improved infrastructure. We have now mapped out three water catchment areas with local communities, have discussed management actions, and put in place community-managed tree nurseries for replanting programmes later in 2015. The strategy for rollout is that visible success on a small scale will encourage people to look at wider forest protection.

3. Biodiversity conservation

Dahari first concentrated on developing an evidence base for conservation in the Comoros. Forest maps based on satellite images were produced to understand the extent of current forest and monitor future changes, field surveys produced species distribution models of key taxa to identify hotspots and species under particular threat, and detailed population and distribution studies were undertaken on the flagship species the Endangered Livingstone's fruit bat P*teropus livingstonii* and the Critically Endangered Anjouan scops owl *Otus capnodes*. The results of this work can be found in reports and papers published online (http://www.ecddcomoros.org/resources/reports-and-publications).

The results showed the importance of detailed research before the implementation of conservation programmes: the population of *Otus capnodes* was found to be much higher than previously reported, leading to a recommendation for its downgrading to Endangered, whilst *Pteropus livingstonii* was found to be under high threat, leading to a recommendation for upgrading to Critically Endangered.

As a consequence Dahari is developing its first conservation programmes around the protection of roost sites of the Livingstone's fruit bat. A model of payment for ecosystem services is being developed to compensate farmers for changing land-use practices, with European zoos holding the species and conservation funders targeted for long-term financing. Discussions are currently underway with the relevant landholders, many of whom are already being supported in their agricultural development.

4. Integrating results into a landscape management system

Figure 6 illustrates Dahari's activities in Ouzini, one of the prioritized upland villages. Discussions and planning sessions undertaken in this community and others showed that attempts to develop large-scale management plans as a participatory guide for intervention would not be successful due to low local capacity and cohesion. The approach is thus activity-focused, with different intervention programmes planned separately with relevant members of each community (either individually or in small cohesive groups). As natural resource management actions progress we aim to mobilize more villagers around this work and undertake wider landscape management planning exercises to draw results together into long-term plans managed by local community groups.

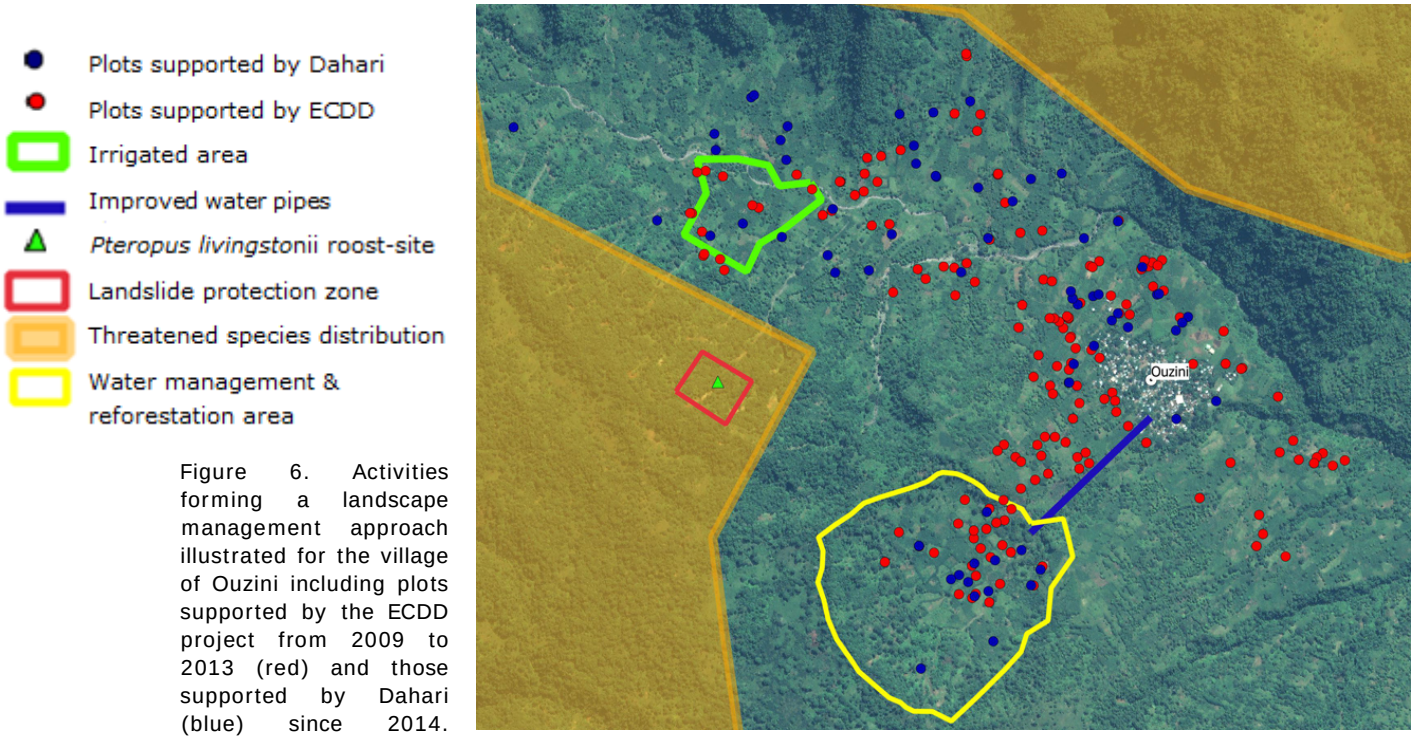

Figure 6. Activities forming a landscape management approach illustrated for the village of Ouzini including plots supported by the ECDD project from 2009 to 2013 (red) and those supported by Dahari (blue) since 2014. Images Pléiades © CNES 2012

Discussion

This is the first time that a landscape management approach has been applied in the Comoros, and the high pressure on agricultural land and natural resources coupled to the low institutional capacity has brought severe challenges. Whilst the work is far from complete, Dahari's success links back to its original philosophy of intervention:

1. Previous interventions in the Comoros with conservation aims lost the trust of villagers who felt their own needs were not prioritized. Foregrounding natural resource management for immediate benefit whilst building an evidence-base for conservation has avoided these issues.
2. In the context we are working 'participation' has often led to the creation of illegitimate community bodies whose members are adept at siphoning off the benefits of 'development' to a small subset of the community. Our field technicians' in-depth knowledge of structures and individuals and the learning gained from different collective projects has allowed us to identify leaders to support in collective work, whilst directing interventions to their end goals.
3. Looking to tackle the root-cause of problems led to intervention at the landscape level. While that requires long-term investment, it is the only way of achieving sustainable outcomes.
4. Breaking the poverty-deforestation cycle rather than environmental education has been the key to getting buy-in to conservation from villagers, who talk nostalgically of a time when there was more forest, greater productivity, more water, and more wildlife.
5. We spent a long time working to avoid previous intervention models that paid people to work on collective projects and even for activities in their own fields, with rare long-term impact. The only way of ensuring that the beneficiaries are committed and will maintain activities has been to get them to invest their own time and resources, even if this slows implementation.
6. Testing interventions, undertaking studies, evaluating their effectiveness and reformulating or abandoning those that have failed has been essential to progress.

Conclusions / outlook

In searching for a holistic approach that tackles the different pressures on the landscape, Dahari is now working with partners to explore a variety of new interventions in line with the theory of change (Figure 3). A detailed study on wood-use will be performed in 2015 with the aim of identifying ways of reducing extraction of old-growth forest for timber and charcoal. Export of market garden crops to the capital Moroni and to the French island of Mayotte is being developed to offer a stable and substantial increase in revenues to producers, a market opportunity that could be tied to contracts with farmers depending on the sustainability of the practices they use.

Other activities being explored for the medium-term include tackling poor health outcomes and improving access to family planning services, improving education services, improving marine management to revitalize reef systems and restock coastal fisheries, and improving revenues from the cash crops ylang ylang essence, cloves and vanilla.

Accepting such challenges might seem beyond the remit of a conservation-led organization, but it will be the only way of achieving long-term sustainability in the Comoros.

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