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Revisiting the Resilience of Chestnut Forests in Corsica: from Social-Ecological Systems Theory to Political Ecology

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ABSTRACT. The “chestnut civilization” is often used to qualify agrarian inland Corsica. Based on a critical review of historical sources and research on present dynamics, we show how this “civilization” has built up on a long series of resistance and adaptation to external political forces, from Genovese and French domination up to the present period of independence claims. The construction of the castagnetu, the Corsican chestnut (*Castanea sativa* mill.) forest, as a social-ecological system is based on a constantly evolving compromise between wild and domestic attributes, but also on socio-political resistance, incorporation, and innovation. We argue that the castagnetu’s resilience, beyond its social-ecological qualities and its economic profitability, is closely linked to a constant incorporation of identity and cultural values into chestnut trees and gardens, but also to the role assigned to the castagnetu by its supporters in the political positioning of their relations to both central power and outside actors.

Key Words: *chestnut; Corsica; political ecology; resilience; social-ecological systems*

INTRODUCTION

Chestnut (*Castanea sativa* mill.) is usually considered a natural, spontaneous, wild resource. This overlooks the fact that in many regions of southern Europe it was maintained with the support of a specific agrarian and social system often identified as the “chestnut civilization” (Pitte 1986), a resource management system extending its influence from local social structures to political relationships between chestnut growers and the state.

Chestnut culture in Corsica constitutes an original example of domestic forest: a system dominated by trees, between wild and humanized, where ecological and social components are closely interweaved. Nevertheless, because of the various interpretations and ideologies attached to the term “forest”, and because the Corsican name “castagnetu” and its French equivalent “châtaigneraie” have no direct translation into English, we will use the Corsican name “castagnetu”.

The contemporary castagnetu is quite different from the postmedieval chestnut harvesting system, the

19th century flourishing subsistence castagnetu, or the decaying chestnut stands of the industrial revolution. However, what relates these different phases is the persistence of a complex biocultural relationship system connecting trees to humans, landscape to uses and techniques, and ecosystem evolution to the local society’s internal dynamics. From its emergence to its contemporary revival, chestnut culture allows for a rigorous analysis of principles of coevolution between the social and ecological subsystems. The long chain of innovations, adaptations, breaks, and continuities that maintained the system until now allow for a questioning of its internal resilience.

We first discuss the role of this intricate biocultural relationship system in the castagnetu’s resilience. Change is analyzed in terms of adjustment, adaptation, or disruption operating in a correlated way in the different subsystems, i.e., tree biology and ecology, socio-technical systems, local institutions, and rules, and over different temporal and spatial scales. We present this social-ecological system in three steps. We first focus on the elementary social-ecological unit: the chestnut tree, replacing the construction of cultivar diversity in an

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interplay between biological necessity and cultural identity, and analyzing the social-ecological role of practices that aim at maintaining the tree in the human sphere. We then expose how the oscillation between wilderness and humanity has been instrumental in the resilience of the chestnut forest. We finally concentrate on the “chestnut society”, emphasizing the coevolution of economic and socio-technical systems, and explore how resilience has been historically managed through the adaptation of ownership and behavior rules.

The castagnetu is also integrated in wider agrarian, social, and political systems, that determine another set of complex conditions of existence and transformation. A socio-historical perspective, analyzed through a political ecology approach, allows for a reinterpretation of the castagnetu’s resilience in light of the resilience of the wider agro-political system in which it is embedded. We present the castagnetu’s political ecology in three phases. We first analyze the chestnut tree as the instrument of domination of island populations by their Genoese and French rulers. We also highlight its utilization in the island’s resistance to this domination, and explain why it has finally been incorporated at the large scale in the island’s rural economy and livelihood. We then explore its transformation into a positive “natural” value by policy makers. Lastly, we explore the contemporary politicization of chestnut by Corsican farmers in the context of growing identity claims. We conclude with a discussion on the necessity and validity of combining approaches in resilience thinking.

A BRIEF OVERVIEW OF THE HISTORICAL DEVELOPMENT OF CHESTNUT CULTURE IN CORSICA

Corsica is a mountainous Mediterranean island. Under Italian domination for six centuries, it was transferred to the French Kingdom in 1768 and then became part of the French Republic. Until the mid-16th century, the island was managed through an extensive silvopastoral system with a double transhumance whereby people and herds moved between the winter grazing lands in the coastal plains and the mountain rangelands. Grain cultivation was sporadic. From 1548 throughout the 17th century, the Genoese Authority introduced the compulsory cultivation of chestnut. Shepherds slowly became chestnut growers and settled more permanently in mid-mountain villages, which

altogether reorganized the food system, the socio-technical equipment, the island economy, and the whole socio-cultural system. Chestnut culture fully developed during the 18th and 19th centuries, providing flour for daily meals, fodder for animals, i.e., sheep, goats and pigs, and fresh fruits for trade. It supported booming population densities, the highest densities in Europe by the end of the 18th century, up to 140 inhabitants/km². By the end of the 19th century, local industries development, rural population hemorrhagic outflow toward urban centers, and the agony of mountain agriculture effected the collapse of chestnut culture. Around 1980, the history was again reversed. Local initiatives started to rehabilitate the decaying chestnut trees and re-established the chestnut economy within contemporary market dynamics (Fig. 1).

A SOCIAL-ECOLOGICAL SYSTEM: CONSTRUCTION AND RESILIENCE ACROSS SCALES

The chestnut tree: back and forth between wilderness and humanity as a strategy for survival

The chestnut tree is probably the most “humanized” of all European forest trees; it was managed and planted for fruit production in antique Roma, and further domesticated in France, Italy, Spain, and Portugal since the Middle Ages (Pitte 1986). However, unlike other domesticated fruit trees, it still looks like one of the largest native forest trees. This “in-between” status, between wild and domesticated, nature and culture, is the structuring feature of the chestnut system identity. How does it play in ecological and social resilience?

Chestnut domestication in Corsica has produced a great diversity of varieties (Simi 1977) that have been selected, named, reproduced though grafting, and exchanged between villages, and that constitute one of the major features of the island’s chestnut culture. This diversity constitutes both an adaptation to the variety of microenvironmental conditions and a buffer against parasitic and climatic risks. It also allows for extending the harvest period and the array of food uses. Moreover, because of the tree’s auto-sterility, diversity is vital for cross-pollination. In former times, villages’ identity and pride were related to the array of their chestnut varieties that

Fig. 1. Inside the castagnetu.



contributed to a specific flour's flavor ("gout de terroir") and constituted the basis of intervillage exchanges.

This constructed diversity and the socio-technical practices attached to it connect the chestnut tree to the human sphere, but the fluidity and the ambiguity between wild and domesticated remain. Trees reproduced from natural seedlings are considered as wild, even though the seeds come from varieties that have been empirically selected for centuries. These trees, called "bastardu", are considered the best pollen producers, and therefore the strongest reproducers, and provide the best stocks for grafting. In this cultivated system, the quality of the harvest, and the economic success of the plantation, depend on the vigor of a wild component. This incorporated wild quality also played an important role in the ecological resilience of the chestnut ecosystem during the 19th century collapse.

Nowadays, because of changes in chestnut stands management, cultivar diversity is no longer an agrarian necessity. Moreover, its commercial valorization is difficult because most chestnut farmers are not aware of the specific uses formerly attached to each variety, and flour production usually uses a mix of cultivars. However, diversity is increasingly raised as a positive quality for both scientific (biodiversity) and cultural (heritage) reasons.

Chestnut production is directly correlated to human labor input; grafting is essential to maintain the cultivars' qualities and identity and planted trees have to be regularly pruned to produce, which allows maintaining a favorable shape, fostering production, and controlling pests. Without constant care, trees are heavily prone to damage and disease; they slowly decay and stop producing quality fruits, as exemplified by the 20th century's collapse of most of the island's castagnetu. Some farmers clearly relate the boom in canker and ink diseases to the abandonment of chestnut intensive culture. However, the tree's global survival under adverse conditions is ensured by a reversion from domestic to wild; crown dieback and the production of coppice shoots allow for the decaying trees' persistence or revival in the abandoned castagnetu. "Back to wilderness" can be considered as a temporary strategy for the tree's ecological resilience.

From forest to orchard and back: fluid identity and resilience of a cultivated forest

This wild/domesticated duality also characterizes the ecosystem. Where or when do the orchards stop and the forest start (Fig. 2)? How do nature and culture combine to shape the castagnetu? According to chestnut history in Corsica, this ambiguity between wild and cultivated has cyclically been

removed and re-emerged. How has it played in ecosystem resilience?

Seen from an agro-technical perspective, the castagnetu can hardly be assimilated to an “orchard” because this category usually refers to a well-ordered, homogeneously treated plantation of a single tree variety. But is it a forest? Seen from the local society’s perspective, it clearly belongs to the domestic sphere. Along with vegetable fields, the chestnut plots belong to the “circolo” (Ravis-Giordani 1983), the village cultivated and fenced lands, adjoining but distinct from cultivated open fields (“presa”) as well as from wilder bushy rangelands (“maquis”) and forests. Chestnut production, i.e., fruits, flour, and animal products, is clearly attached to the agricultural sphere, not to silviculture. Plot management practices contain wilderness in acceptable limits. Specific construction aimed at water conservation, e.g., irrigation channels and small walls, or at fruit storing and drying enhance human presence in the landscape (Fig. 3). For today’s chestnut farmers, the term “forest” is counterproductive because it negates the cultivated, domesticated, appropriated, and constructed character of the castagnetu.

Seen from a management perspective, the castagnetu exhibits a rather continuous back and forth movement between wild, managed, and cultivated with a coevolution of practices and ecosystem structure. Chestnut production on the island has long been achieved through harvesting managed trees “self established in local forests and woods” (Casanova 1998:18). During the slow establishment of chestnut culture, grafting and plantation of selected varieties coexisted with the management of self-established, ungrafted trees. Afterward, chestnut production was conceived and managed as an intensive monoculture, with labor-demanding practices and high social control. With the industrial revolution, it reverted to more extensive forms of management, sometimes close to gathering, while the clean chestnut plots evolved into dense tangles of unmanaged chestnut trees and self-established maquis bush. Reverting to wilderness, through a more natural forest functioning, allowed the system to survive abandonment. Nowadays, chestnut producers re-enter the abandoned castagnetu and try to invent new production practices that compromise between wild and domestic. Old decaying trees are severely pruned, fruit harvesting and processing are mechanized, but diversity is not managed anymore (Gal I Tré Valli 2005).

Chestnut culture as a social system

Seen from the society’s perspective, the castagnetu has consistently acted as an organizing principle of the individual life cycle, village livelihood and economic exchanges, labor hierarchies, and genealogies. It supported daily subsistence of densely populated villages, providing starches throughout autumn and winter, animal products throughout the year, and income for exceptional expenses. Fruits or flour were traded for olive oil and wine with lowland villages. The socio-technical system was based on specific equipment designed for manual fruit harvesting, drying and processing, and on labor allocation organized by family networks and involving all present generations, from grandparents to grandchildren (Casanova 1998). Economically and socially integrated into the agro-pastoral system, the castagnetu was ensuring the long-term continuity of economic and social structures. Because of its longevity, the tree represented the link between generations because a tree planted and grafted by an individual was supposed to benefit the next four generations.

At the turn of 20th century, with the opening of island rural societies to more global agrarian and industrial economies, the castagnetu became a provider of income for social and geographical mutation through the felling of decaying trees and the sale of timber to tannin industries (Pitte 1986). Solidarities attached to the castagnetu were thus redefined; consuming the chestnut rent established by former generations allowed for the adaptation of further generations to changing world conditions.

Nowadays, a new chestnut economy is being invented in which the combination of heritage, i.e., inherited knowledge, practices, and biological structures, technical innovations, and new solidarities establish production in a compromise between a tradition linked to chestnut civilization and the modernity of a market economy (Auclair and Michon 2009). New practices are developing that displace the former socio-technical position of chestnut culture, i.e., valorization of extensively managed castagnetu through pork production (pork products issued from local types of pigs grazing on chestnuts are famous local specialties in Corsica), or exploitation of timber which is still at an experimental stage under the supervision of Forest Services. Former community ties have been replaced by a variety of social and professional networks, e.g., chestnut producers groups, the “Appellation d’Origine Contrôlée” organization (a

Fig. 2. An overview of the castagnetu.



type of official, geographical indication), and the Bucugnà fair, extending beyond the island society (Gal I Tré Valli 2008). Intergenerational linkage does not refer as much to economy as it did before, but chestnut's growing patrimonial value is now redefining the link to heritage and tradition throughout the island society (Michon and Sorba 2008).

The formerly dominating silvopastoral system has not been supplanted by chestnut culture but has slowly integrated it. One of the key factors of this incorporation and of the castagnetu's global resilience relies on the social treatment of the everlasting tension between tree farmers and shepherds, assigning the respective places for trees and animals. This resilience basically depends on deep modification of the appropriation system and establishment of strict behavior rules for the different stakeholders.

In the former, prechestnut resource management system, most of the lands were under common property, either at lineage or village levels. Collective and egalitarian rules organized grain cultivation and animal mobility but hardly accommodated tree culture. When Genoa started to impose chestnut cultivation, drastic changes had to be made because chestnut tree plantation logically

induced long-term land appropriation by individuals and their descendants. The major innovation occurred through the invention of a property system dissociating rights to the land and rights to the trees: trees planted on the commons were privately owned by the planter and his heirs, but the land itself remained the property of the village. This customary particularity in land property systems was introduced very early, as soon as islanders realized that they could not escape the compulsory tree cultivation system, on the village commons as well as on undivided lineage lands and on church properties. It was reinforced as chestnut culture freely developed during the 18th century when most farmers could not afford to buy agricultural land for their plantations. It remains up to the present day and is acknowledged in article 533 of the Civil Code (Nouvel 2000).

The protection of trees and harvest against animals was also ensured through various rules, including the permission for fencing the land around young trees, and controlled animal circulation under mature trees through the supervision of a shepherd. The most original rule concerned the total prohibition of animal circulation in the castagnetu during harvest period; in this system called "furestu", shepherds had to keep the animals away from the unfenced castagnetu during the entire

Fig. 3. Building within the castagnetu.



restriction period that was set by the village assembly, and they were held responsible for any damage to the harvest.

These practices allowed for a mutually beneficial cohabitation of trees and animals throughout three centuries. Today they are meaningless because most of the chestnut territory is not tended anymore. However, other compromises have to be developed to allow for a harmonious cohabitation between chestnut growers and other stakeholders, i.e., pig farmers and their extensive forms of space and resources management; urban dwellers who consider the castagnetu as a free space for gathering wild fruits; and investors who start considering chestnut land for residential development.

AN EMBEDDED SYSTEM: POLITICAL ECOLOGY AND RESILIENCE OF CHESTNUT CULTURE AT WIDER SCALES

We now want to highlight how conditions and directions of change are linked to political and economic processes at wider scales. Drawing on a political ecology approach, the castagnetu is discussed as a more global social-ecological system resulting from, but also embedded in, the interaction between local populations, external socio-political forces, and the environment.

The castagnetu's political ecology largely refers to the complex and changing relationship between the island population and its successive administrators. These relations involve misunderstanding, conflict, coercion, oppression, and disqualification, but also indirect cooperation, adaptation, and incorporation. From the Genoese Administration to the French Fifth Republic, the castagnetu appears as the main arena of confrontation not only between Corsican farmers and the administration, but also between insularity and rurality, considered as the essential attributes of Corsican and mainland or urban development values.

Chestnut and domination: from compulsory chestnut cultivation to resistance and controlled incorporation

From the Genoese domination to the French administration mandated by Louis XV and his successors, the island rulers consistently tried to impose their agrarian and social ideology; for them, existing resource management systems closely aligned to wilderness had to be replaced by more civilized practices, i.e., agriculture. Chestnut was central in this transformation/domination system; Genoa tried to impose it to settle mobile pastoral populations, whereas France tried to destroy it because it was held responsible for the island's

economic and moral underdevelopment (Pitte 1986).

From 1548 to 1850, successive chestnut policies largely relied on the perception of native Corsicans as backward, amoral, and violent salvages reluctant to adopt civilized agriculture and modern social institutions such as land property, wage labor, or capital accumulation. The first Genoa Governor in 1548 referred to the “laziness” and the “listlessness” of islanders who “leave their lands unploughed” (Serpentini 2000:45). According to this attitude, population mobility linked to silvopastoral practices “enhances violence”; planting chestnut will settle populations and pacify them. For the French Kingdom, chestnut was also “the food of laziness” because “a chestnut forest does not require any cultivation” (de Pommereul 1779, as cited in Pitte 1986:116). Chestnut was considered a weapon in itself because it provided food during wartime and constituted a refuge for rebels (de Marbeuf 1769); thus, uprooting the tree would weaken resistance against the new rulers.

For Genoa, chestnut imposition was also a necessity linked to colonial policies; it facilitated coastal land allocation to colonials because it helped settling populations in midaltitude villages, and released land for cultivation, leaving surplus for export, because chestnut provides greater amounts of starches than grain cultivation. For France, the domination of chestnut, which comprises up to 88% of village lands, “deprives the island from the enormous advantages it could draw from the cultivation of wheat and all sorts of grains” (as stated in Louis XV’s ordinance of June 22nd, 1771, restricting new plantations: Arch. 1771, as cited in Pitte 1986:117).

Corsicans consistently resisted those policies that were so incompatible with their livelihood system. Under Genoese domination, resistance went through a phase of rejecting the chestnut, and it took more than a century for Genoa to impose the chestnut tree; five ordinances were promulgated between 1548 and 1646. Under French occupation, defending the chestnut tree had become a means for asserting identity and self-determination, and Louis XV did not succeed in restricting its plantation.

Beyond the overturn of chestnut’s role in local political struggles, the association of the chestnut tree to independence, freedom, and resistance to the oppressor is constant throughout the island’s

history. Resistance consistently relates to the global confrontation between local agrarian values and administrative development ideologies. From the 16th to the 18th century, the early capitalistic dynamics of colonizers could not accommodate the island’s communitarian “horto-pastoral” (Dumont 1952) civilization in which money hardly existed, development of social relationships was more important than accumulation of commodities, and property was not a precondition to production but the result of human labor (Casanova 1998). Rural evidence did overcome these agrarian utopias; Corsican shepherds succeeded in diverting chestnut to the benefit of existing resource management systems whereas their growing protestations led Louis XV to give up his policy.

In spite of resistance to Genoese policies during the 17th and 18th centuries, chestnut pervaded throughout the island economy. However, this slow domination of the chestnut tree did not meet the objectives of the Genoese administration, which was the replacement of nomadic pastoralism by settled arboriculture, and of common property by individual land ownership. During the 18th and 19th centuries, the tree was literally reinterpreted by Corsicans and incorporated into geographical, legislative, and mental spaces liberated, or created, in the prevailing systems by technical, institutional, and social innovations (Pitte 1986). Most authors analyze this incorporation as economic and Malthusian evidence; chestnut culture was the only system able to produce enough starches for the growing island population and allow for further development. This positive relationship between chestnut production and demography is not the only factor. The foreseen incompatibility between pastoralism and tree culture on which Genoa had based its policies was reverted by the dynamism of local systems and practices that made chestnut culture and pastoralism quite complementary; the castagnetu offered additional space and resources for animals whereas seasonal labor involved in chestnut production followed the rhythms of herds’ movements (Ravis-Giordani 1983).

The adoption of chestnut culture as the basis of daily subsistence therefore led neither to the expected destitution of existing resource management systems (the double transhumance still exists today) nor to the liberation of land for grain production; in 1850, chestnut culture covered 33,000 ha as opposed to 14,400 ha for grain culture. On the contrary, while extending the possibilities of the

former silvopastoral system, it allowed a quick intensification of production systems and a noticeable improvement of local livelihoods, entailing demographic and economic development that could not have been possible through the former extensive pastoralism. This success was also strategic in the resistance against French antichestnut policies and constituted a key factor for the global system's resilience.

The construction of chestnut as a positive value by political elites

Until the mid-19th century, successive political and cultural elites viewed chestnut unfavorably. The situation then radically changed; technical services, scientists, and intellectuals started praising chestnut. This inversion was linked to major changes occurring in global economic systems as well as in the chestnut system itself. It went through a total redefinition of chestnut and its reappropriation as "an element of OUR local FOREST wealth" (Arch. 1887; author's emphasis). In adopting chestnut as a forest tree that "maintains soil and water" and "ensures a good climate" (Arch. 1887), policy makers not only completely alter it through abusive naturalization, but also confiscate it to the benefit of forestry services. This sudden valorization of castagnetu by policy makers corresponded to its collapse as a farm-based social-ecological system. As farmers started making profits in cutting chestnut and selling timber to local tannin industries, the administration endorsed its protection. The castagnetu was not praised because of its positive contribution to rural livelihoods, but precisely because chestnut farmers abandoned it and perpetrated the "assassination of a FOREST" (Méria 1970, as cited in Pitte 1986:290; author's emphasis). Once again, chestnut policies ignored the logic of local dynamics, and were aimed at enlightening chestnut farmers who were again considered backward, ignorant, and grasping ("making them understand the seriousness of their situation, and understand their real interest": Arch. 1891), and at protecting the trees against the "carelessness of their owners" (Arch. 1902).

The castagnetu was collapsing, and with it the productive chestnut landscape and civilization. However, this collapse was essential in the resilience of local livelihood systems because it played a key factor in their global transformation; income provided by the cutting down of decaying

trees allowed for agricultural modernization and helped local development, whereas the global decay of the chestnut base stimulated out-migration toward urban centers and distant colonies.

The political reconstruction of chestnut as a positive local value by producers

After almost a century of naturalization through ecological dynamics as well as policy efforts, as elsewhere in Europe (Pesteil 2001, Dupré 2002, Bromberger et al. 2004, Chassany and Crosnier 2006, Giundani 2007), the Corsican castagnetu is reviving. It stands at the heart of a local reappropriation movement raising rurality, insularity, and cultural identity as positive values founding local development. Even if it is still in search of sustainability, the 21st century castagnetu revives through denaturalization of the ecosystem and socio-technical modernization. Contrary to other rehabilitation movements that capitalize on environmental qualities of local chestnut culture (dos Santos 2005, Giundani 2007), Corsican chestnut farmers use the heritage of locally evolved knowledge, social links, and culture as the main resource for chestnut rehabilitation, and adapt it to the technical and economic conditions of the 21st century. They fight against the common perception of chestnut landscapes as natural forest wealth, highlighting why and how locally born knowledge and social networks that have built these landscapes have to be reinvented to fight castagnetu's asphyxiation by bushes and diseases. Beyond chestnut, they assert that, in contrast to the image of Corsica as a natural paradise, Corsican nature can only be saved by culture (Michon and Sorba 2008).

Unsurprisingly, the relations of the new chestnut farmers to local administration and policy makers are often problematic, but the renovation movement is trying to break its historically corrupted relation to local and national socio-political hierarchies in establishing new alliances with wider social, technical, and political networks. They are exchanging experiences with other chestnut-producing regions in the Mediterranean, forging new relationships to consumer groups, to universities, and research centers, accessing European development institutions and funding, and displacing the latent conflicts between farmers and the island's socio-political elites in charge of rural development.

DISCUSSION

Our analysis raises important questions: at which scale(s) and through which coupling of technical, social, and ecological subsystems should change and adaptation be addressed and assessed? How can we construct an idea of resilience that encompasses the complexity of ecological, technical, social, economic, and political realities?

We have tried to address these questions by examining the complementarity between two different academic approaches, one attempting to understand local-level resilience through the analysis of coupled technical, social, and ecological subsystems, the other further testing resilience ideas at larger scales, looking at socio-political and institutional forces through the analytical frame of political ecology. We have also largely integrated the historical dimensions of change. The few analyses of chestnut systems transformation in Europe either emphasize the global history of chestnut development (Bruneton-Governatori 1984, Pitte 1986), which does not take into account the local transformations of coupled ecological and technical subsystems, or concentrate on local, internal histories linking local practices to social or agrarian factors (Moreno 1989, Casanova 1998). In an attempt to harmonize both approaches, we have produced an analytical framework developing several imbricate scales: starting from the evaluation of local social-ecological systems' resilience at different levels (tree/practices; ecosystem/practices; resource management/livelihood outcomes/local institutions) and reinterpreting it in light of complex interrelations developed at larger scales (global resource management system/socio-political processes).

The understanding of local-level resilience focuses on the intricate relationship between transformations in natural, technical, social, and institutional subsystems at different levels ranging from the tree to intervillage territories. This approach has highlighted not only the importance of re-evaluating the resilience of ecological subsystems within the frame of local human subsystems but also the existence of coevolutionary processes between these different subsystems. We have shown that these processes are also nonlinear; in developing chestnut, human action has transformed local nature, the evolution of which, in turn, became a determining factor in shaping and influencing techniques, practices, rules, decisions, and choices

made at individuals and collective levels. The chestnut system has cyclically existed as a forest, i.e., the managed forest of the postmedieval period and the 20th century abandoned stands, as an intensive orchard designed and maintained by regular human intervention, and as a mixed-garden, i.e., the semiwild/semidomesticated castagnetu of the 17th century or the contemporary chestnut system. This fluidity, whereby practices, institutions, i.e., social objectives, relations, and rules related to chestnut, and stand ecological conditions are constantly coevolving, is certainly the main condition for successful resilience at local scale.

The second movement in the analysis emphasized the fact that local socio-environmental processes are nested in and connected to dynamics occurring at other scales and in other domains where political and economic interests become major drivers of change and complexity. This approach has shown the central role of the castagnetu's development and transformation in a global socio-political and agrarian construction allowing for resilience of the island rural system through adverse, sometimes brutal, political conditions. By doing so, we have reframed the castagnetu's resilience within the resilience of larger systems, ranging from global resource management and livelihoods of inland Corsica to relationship systems relating local societies to the outside world. This analysis also reveals the complex network of opposed ideologies and practices relating political administrative hierarchies and chestnut farmers. In spite of inadequate and potentially destructive policies based on persistent ignorance or misunderstanding of local realities and continuous disqualification of local populations' practices and culture by policy makers, chestnut farmers have consistently pursued their own dynamics. Nowadays, globalization tends to erase this traditional tension between chestnut farmers and policy makers; chestnut future depends more on distant collaboration, exchange, and aid than on local or national hierarchies. This break in chestnut's political subsystem, combined with constructive innovations in the technical and economic subsystems, allows for a new phase in the resilience of the global chestnut livelihood system.

CONCLUSION

Conceived as a conceptual framework linking the evolution of ecological communities and social systems (Berkes et al. 2003), resilience thinking also

aims at understanding the diverse set of processes that drive social-ecological change at multiple scales (Holling 1996). Difficulties arise from the complexity of social-ecological systems, which makes it difficult to fully incorporate social, economic, and political realities at various scales (Anderies et al. 2006). Theoretical models of resilience therefore often fail in guiding comprehensive analyses of change in real, complex situations where change and responses to change are articulated through a diversity of variables, processes, and scales. Alternative socio-environmental approaches have to be mobilized that place more emphasis on the influence of social, political, and economic structures, or institutions and actions across scales in shaping the evolution of local social-ecological systems. The combination of resilience thinking and political ecology may facilitate understanding the multiple levels and facets of interaction within complex human ecosystems; these approaches represent two complementary and converging transdisciplinary attempts to address the relationship between human and ecological dynamics of change.

The purpose of our analysis, using the castagnetu as an example, has been to evaluate how the combination of these two approaches allows for developing a comprehensive analysis of resource development, accumulation, and degradation, of practice adaptation and innovation, of social-ecological collapse and revival in a particular social-ecological system. In doing so, we hope to have demonstrated that tracing connections across spatial, temporal, and intellectual scales is both necessary and valuable in the analysis of complex social and ecological systems.

Responses to this article can be read online at:
<http://www.ecologyandsociety.org/vol16/iss2/art5/responses/>

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