Landscape Ecology and the Venice Lagoon

Meaning and potentiality of the landscape ecology approach in the Venice Lagoon Landscape management

Daniel Franco

1ST THE APPROACH UTILITY

Landscape ecology is a fast developing discipline. It born in Europe, linked to geography and to the solution of landscape management problems. Instead the later development in the United States (but then in Europe too) sprouted from a more biological basis and has been more oriented to the spatial heterogeneity effects on the ecological processes.

The deep ecological roots, as the key concepts linked to the functional relationships of structures and fluxes (of information, energy and matter) in the landscape system, let the discipline the to be innovative in landscape study and management.

Landscape ecology considers in an explicit way the human influence in the (landscape) ecological processes, tries to account for the time and space scaling problems, it accounts for the ecological meaning of "memory": the landscape is a complex system that retains a recall of the ecological conditions and of the disturb regimes (at several scale) that have been present during its evolution.

2ND SCALING AND MEMORY: TWO EXAMPLES

2nd.I The geo-morphology - climatic scale

This time scale let us to understand the uniqueness (and rareness) of the floristic characteristics of the ecotopes mosaic, and its management implication.

- A the end of the last ice age (10.000 years BC) the sea level was low, allowing the vegetation of alpine species. The today heritage of its period it is represented by *Teucrium chamaedris* or *Stachis recta*.
- The next warming and high sea level period (with a maximum around 5.000 years BC) allowed the migration of the steno-Mediterranean species, for example the surviving *Quercus ilex* and *Asparagus acutifolius*
- Then the drought period (with a maximum around 2.500 years BC) does explain the today presence of some stepping species (as *Tracomitum venetum, Sacabiosa alba*) migrated from East.

- The complex of the specific ecological condition that characterize this transition systems at this scale lag, then, explain the genetic selection of the endemic species as *Centaurea Tommasii* and *Salicornia Veneta*.

2nd.II Changing the time scale resolution: the human influence

If we dramatically change the time scale resolution and we consider only the last millennia, others ecological disturbs do appear to be the main shaping factors of the today landscape.

- pre-Roman and e Roman age

The North Adriatic coast has been inhabited until the prehistoric age, but were the Romans, after the deforestation stared from Neolithic, that intensively transformed this landscape by means of the *centuriae* reclaim and cultivation systems and of the coast settlements (Ravenna, Spina, Altino, Aquileia). These transformations led to a growing sediment run off, speeding the lagoon filling process.

- Around the first millenium

In this period the human contribution to the landscape transformation became more evident. To guarantee the ports (Lagoon) navigability, the local society (quickly developed from the VI century) tried to slow down the filling process by means of dams in front of the lagoon rivers' mouth. This protection became stronger and stronger by means of the constitution of a specific Office (Savii delle acque) starting from the XIV century (***Table 1***).

- The modern age

In this period the ecological transformation of the Lagoon landscape due to the human needing have been intensified (***Table 1***). All the principal rivers have been diverted from the Lagoon to the Adriatic sea and the shoreline and the port entrance have been more and more protected, to guarantee the community safeness and the economic activities (e.g. the port utilization by a more draught needing shipping). But the lacking of sediment filling let now the lagoon to be more sensible to the sea erosion and influence (more preferential/rapid water dynamic, less fresh and more salt water).

Table 1 Chronology of the mains actions to control the lagoon morphological evolution.

1324	S.Marco bank
1534	Taglio del Re and Cava Zucchina
1540	Stop the diversion of Bacchiglione and Brenta rivers
1599	Taglio (diversion) of Porto Viro
1600	Tagli of Garzoni e S.Ilario
1610	Taglio Nuovissimo
1639	Diversion of Piave river
1683	Diversion of Sile river
1725	S.Spirito channel
1727	Transformation of Porto Lido and Malamocco
1787	Murazzi
1791	Conterminazione lagunare

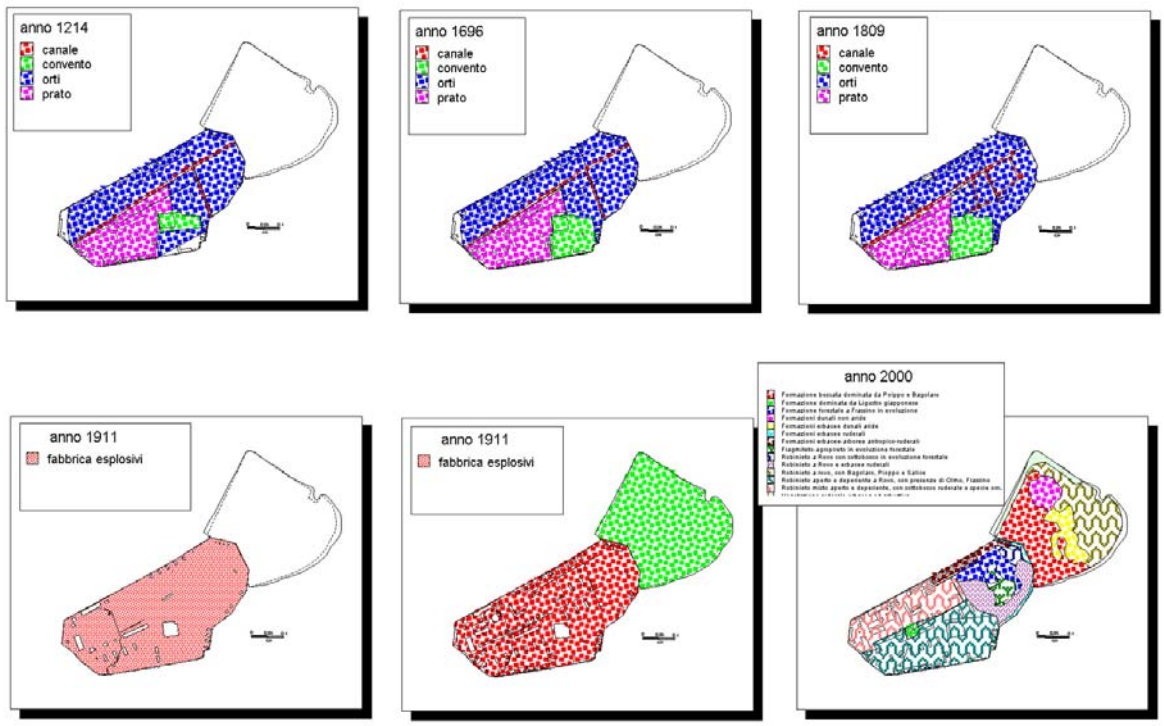
3RD LANDSCAPE ECOLOGY APPLICATION: AN EXAMPLE

A study was performed to define the landscape ecological characteristic of the one of the 36 Lagoon Island (Certosa), to use it in a multi disciplinary planning effort.

The landscape ecology approach was based on (i) the spatial pattern analyses of the ecotopes mosaic in a wide temporal scale (starting from existing documents), (ii) the estimation of some landscape "values" at different spatial scale.

To do this, the Island ecotopes have been classified by means of vegetation land cover measured (today) or estimated (past) (***Figure 1***).

Figure 1 Evolution of the ecotope mosaic starting from the XIII century.

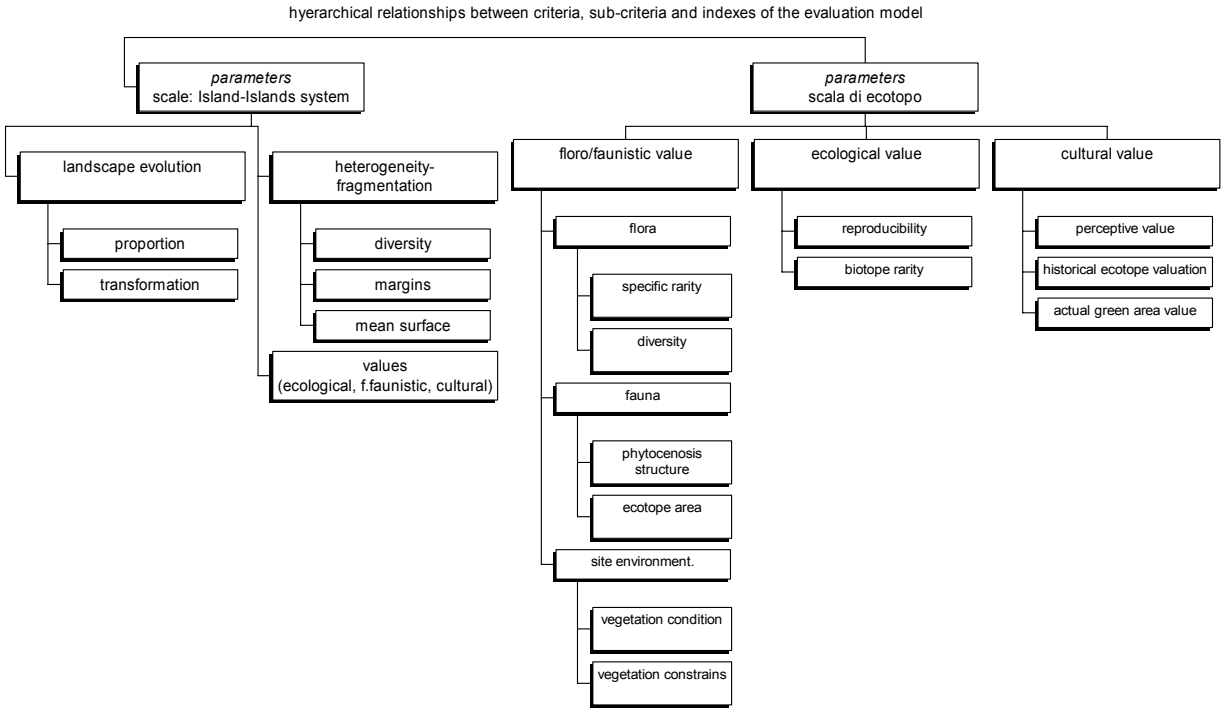


1.1 Valuation

The evaluation model does utilize some indexes (less redundant / most robust) hierarchically connected each other to allow some synthetic judgements at the ecotope and landscape (ecosystem mosaic) level (***Figure 2***). Given the multiplicative logic of the hierarchical relationships, the low level indexes have the same potential influence to the final judgement. The structure of the model allows the decision maker to rebuild the evaluation process (clearness and transparency of the judgement).

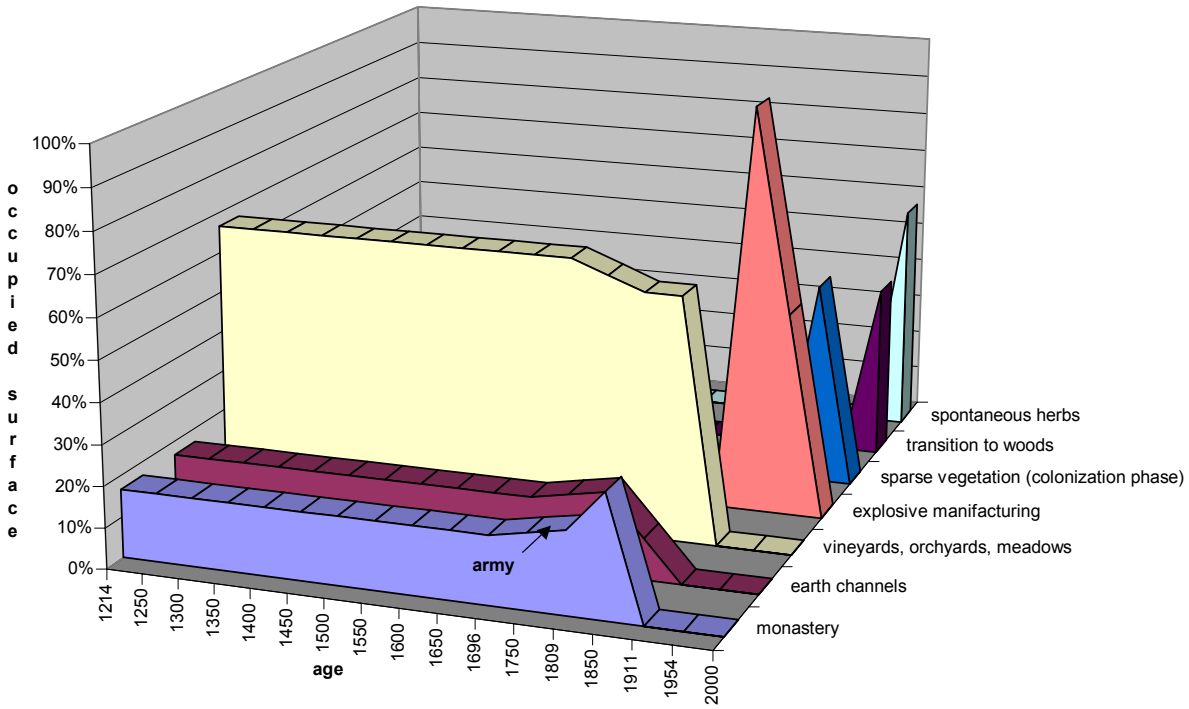
At the ecotope level the parameters used are the floro faunistic value (estimation of the ecotope capacity to maintain biodiversity), the cultural value (estimation of the social perception of the aesthetic and historical value of the ecotope), and the ecological value (estimation of the probability that the biotic and abiotic relationships of the ecotope could be reproduced).

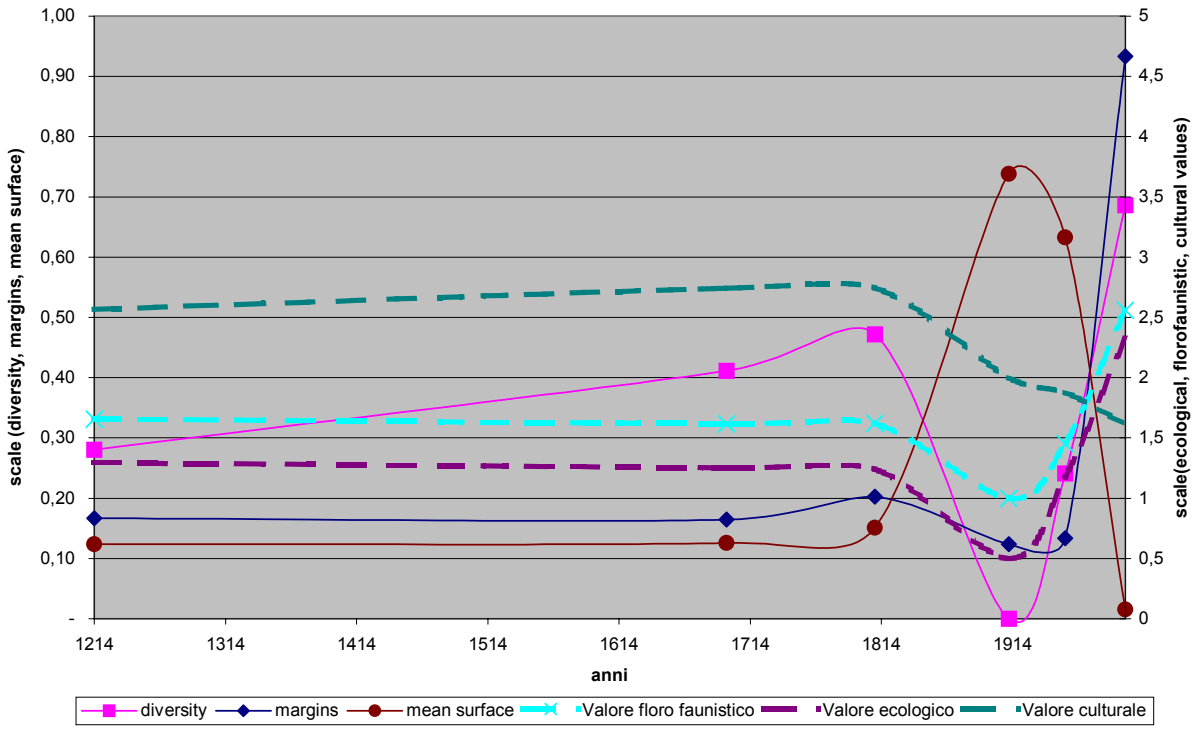
Figure 2 Structure of the evaluation model



The parameters used at the Island scale synthesize the degree of the spatial organization and heterogeneity transformation, and estimate the cultural, ecological and floro-faunistic values at the Island scale (Square root surface weighted average of each ecotopes) (in ***Figure 3***).

Figure 3 Evolution at the ecotope scale and at the landscape scale of the model estimation parameters at the Certosa Island.





2 CONCLUSIONS

The ecological/cultural legacy of the Venice lagoon landscape comes actually from the co-evolution of non human and human processes at different scale, and the human processes (in terms of information, energy and matter fluxes) that contribute to transform he landscape pattern can be considered as ecological processes in a landscape ecology perspective.

We need to consider these dynamics to develop sound evaluations in a decision process for planning or design purpose, and, in fact, in the application case the landscape dynamic shows that:

1. the Certosa spatial pattern (rural configuration) have been table for 7 centuries, and then changed abruptly (low diversity during the military- industrial period, high diversity after the abandonment);
2. the natural (floro-faunistic) and ecological (reproducibility, rareness) "values" at the ecotope and Island scale are generally low;
3. the cultural weight has to be accounted for the ecological planning destiny of the Certosa Island (as for all the Lagoon);
4. the highest ecological interest now lies on the scientific analysis of the ecological evolution (unknown)of some developing ecotopes;
5. the cultural values of the single ecotopes and of the whole Island are generally low, but high from the planning expectation point of view.