

1. Before execution hillside works

1.1 What are hillside works?

(1) Restoring vegetation to control constant sediment runoff.

- *Sabo* projects have long been carried out as hillside works and torrent works executed as part of flood control projects to prevent sediment disasters along downstream rivers. Hillside works that are positioned as hillside projects are a type of work that can be defined as the foundation of *sabo* that controls the constant sediment runoff by restoring vegetation on collapsed land in water resource areas and deforested land where sediment is produced.
- Hillside works are categorized as 1) hillside foundation work that stabilizes slopes on hillsides and prevents erosion of the slopes, 2) Hillside revegetation works to restore greenery by transplanting trees to prevent or mitigate the occurrence or expansion of ground surface erosion or the collapse of surface layers on collapsed land and deforested land, and 3) Hillside slope reinforcement to increase the resistance to collapsing of collapsed ground or a collapse itself. Executing these individually or in appropriate combinations controls the production of sediment.

(2) First restricting the motion of sediment on the hillside slope by hillside foundation work or hillside slope reinforcement work is counted on to encourage the natural invasion of vegetation.

- First, the movement of sediment is controlled by hillside foundation works to stabilize the hillside slope, guaranteeing the foundations of a habitat for vegetation. After the hillside foundation work has been executed, the hillside is monitored in expectation of the natural invasion of vegetation.

(3) When it is not possible to count on the natural invasion of vegetation, further hillside revegetation work is performed.

- When rapid revegetation is necessary to control sediment, or when the natural formation of vegetation cannot be counted on because of local conditions (there are no nearby stock trees for example) further hillside revegetation work is done to help establish vegetation.



Tsuchiyabara hillside work: Early stage of execution in 1989



**Tsuchiyabara hillside work: 2001
The natural recovery of grasses and trees can be seen.**

1.2 To avoid failure

(4) Clarifying the improvement targets.

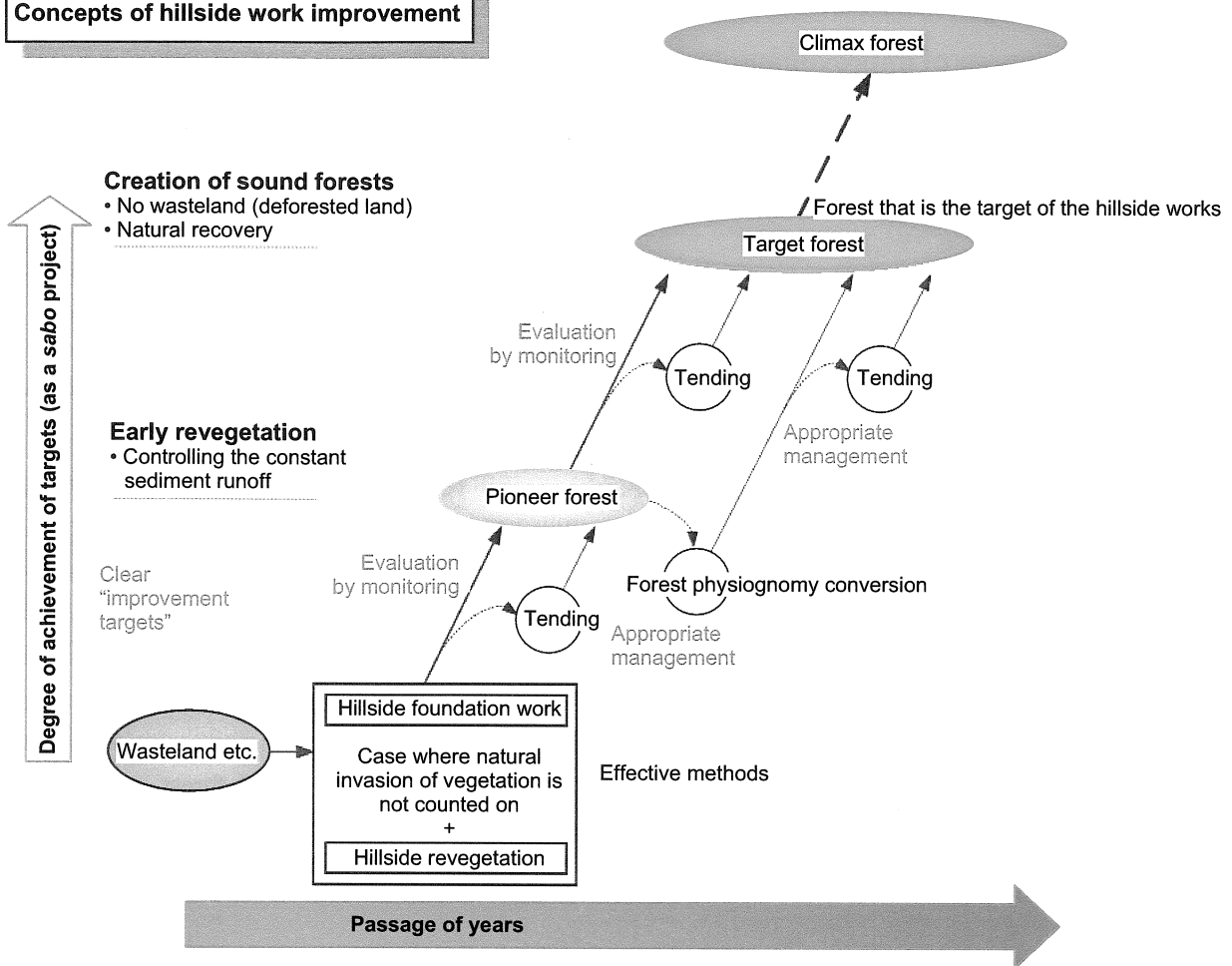
(5) Selecting effective “methods”

(6) Evaluating the degree of achievement of the goals over years

(7) Performing management appropriate to conditions

- Hillside works unavoidably have unexpected results, because the improvement is done taking advantage of the effectiveness of vegetation (living organisms) according to the characteristics of the work method. Measures necessary to avoid failure are clarifying the improvement targets of the *sabo* project, initially selecting effective methods to achieve these targets, evaluating the degree of achievement by observing the state of the vegetation over years, and to support the achievement of the targets according to circumstances, introducing appropriate management such as tending the vegetation or forest physiognomy conversion.

Concepts of hillside work improvement



- Pioneer forest:** a forest of early maturing deciduous broad-leaved trees such as Japanese alder (*Alnus japonica (thunb.) steud*) or oleaster (*Elaeagnus*) that are resistant to drying and oligotrophic conditions and have nitrogen fixing capacity.
- Target forest:** a forest that has moved from the pioneer forest stage to a stage where it consists mainly of deciduous broad leaf trees such as *konara oak (Quercus serrata Thunb. ex. Murray)* and *sawtooth oak (Quercus acutissima Carruthers)*.
- Climax forest:** Forest that has stabilized in dynamic equilibrium so that its structure and species configuration (species configuration varies according to environmental conditions) remain unchanged.