24. Monitoring Vegetation and Surveying Dynamics

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Introduction

The dynamic aspect of vegetation can be considered as a pattern in the fourth dimension. Study of it is a must for well understanding the green mantle. In the applied side of vegetation science it is also very important to know the dynamics, especially for the future. Man's interest for this goes back to the dawn of history. The herdsman since historical time has to carry his sheep to the 'pastures green' (Psalm 23).

For this he should not only know where these pastures are, but also at what time they are expected to be green so that he may arrive there in time. Prediction is exclusively done by extrapolating knowledge of past and present into the future (see Table 1).

Modern application of this old herdsman's wisdom is done not only in the field of grazing but in any aspect of land from pollution to commercial interest in expected yields and then is called 'monitoring'.

This term is derived from 'monitor' = an older pupil that should watch the younger one about his study and warn if something goes wrong. Later (since World War II) this word is generally used for military warning systems and also for medical systems, even for an apparatus (a television screen). The original word in Latin: 'monere' = to warn. But the aspect of watching (necessary base for warning and admonishing) became dominant in literature and is the part that has given rise to development of modern techniques and instruments.

<table>
<thead>
<tr>
<th>To watch</th>
<th>To evaluate</th>
<th>To warn</th>
<th>To deliberate, to plan</th>
<th>Execute action</th>
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</thead>
<tbody>
<tr>
<td>I. The herdsman sees a sheep deviating from the herd</td>
<td>He judges that the animal goes too far</td>
<td>He throws a stone by his sling or shepherd stick or sends the dog after the sheep</td>
<td>The sheep feels the stone and reaction starts</td>
<td>The sheep returns to the herd</td>
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<td>II. The ITC trained official observes change in land-use or farm pattern or crop growth or range trend</td>
<td>He (she) evaluates this in terms of possible shortage of food or fodder in near future in certain regions</td>
<td>A warning is given to the local administrator and/or farmers or range manager</td>
<td>Discussion starts resulting in planning and or legislation or proposed measures</td>
<td>Plan, or measures are executed</td>
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Feedback to watching the results of action

Table 1. The process of monitoring and its aim - original meaning (monere) - monitoring sensu lato (watching and warning) - monitoring sensu stricto (watching).

Ways of monitoring are executed at different scales from different platforms and by different means of observation and as it is as old as life, because animals and man depend in their struggle for life on watching and warning (each other and themselves), they vary from classical to sophisticated technical methods.

Scale in space and time

The scale and platform vary from the herdsman's eye observation, standing in the middle of his sheep, to the weather satellite using low resolution MSS imagery. The warning can be immediately (and directly followed by throwing a stone via the herdsman's tools or sending the dog after a sheep going astray) to deliberately produced periodic reports after long study of the observed process (via sequential patterns study) with all kinds of sophisticated means, and taking into account political deliberation (e.g. the monitoring of degradation resulting from (over)population and warning about it with all its religious and social and political implications).

The monitoring of vegetation as attribute of land with modern means can be focused on:
- short-term (seasonal) aspects in order to guide short-term measures (agronomic, range management);
- long-term aspects; development of agriculture; general conservation aspects; range administration focused on rangeland improvement and conservation, legislation;
- short-term as well as long-term aspects are involved in monitoring for prevention of catastrophic results of climatic variations causing temporal famine among people and animals. (As any positive tool the latter mentioned application can be dangerous if only such catastrophies are temporally prevented and no structural improvement is done in balance between number of people and animals with the resources. In that case a good warning system will speed up the devastation by excluding a natural sound negative feedback factor);
- the basic unit of the sequential observation (watching) is the cell. This can be a grid cell unit of a computerized geo-information system. It could, however, also be a land-use parcel or a (multidisciplinary) land unit or an administrative unit. This all depends on aim and scale of the monitoring system. The way the data will be interpreted is important too. The pattern in the field (on the map), such as extentions and reduction of vegetation cover, intensity per grid cell, giving indirect information on production, is the main matter of interest.

The means

Monitoring can be done administratively by requesting e.g. farmers to register the land-use yearly and send these data to a central place. It can be done by special observers travelling on foot or any other means through the field, using their eyes as main observation means and existing topo-maps and files as recording means. They can do sequential observation on fixed sample areas and so produce tables and graphs depicting change.

The observation place may be a high place (hill or tower) or a moving aeroplain from where with naked eye observations are done (systematic reconnaissance flight, see Chapter 16A).

The recording means might also be any remote sensing (aerial photograph, satellite imagery, radar, thermal, sonar, etc.) that can answer the questions: what, where and when. So far monitoring is being done in rather detail by ground observation, by making photos of permanent sample plots to watch range condition.

Systematic reconnaissance flights is a common means for qualitative as well as quantitative recording (see Andere, 1981; Croze and Gwynne, 1978; Croze et al., 1978; Gwynne and Croze, 1975a, 1975b; Gems, 1979; Huizing and Zonneveld, 1980; Chapter 16A this book).

Experiments with plant cover estimation by