South Pacific Regional Environment Programme

Training Unit G1

RESOURCE INVENTORIES AND MAPPING

USE OF THIS UNIT

This unit describes simple methods for making maps and inventories of environmental resources. The methods should first be explained to the group, preferably with the help of drawings or a blackboard. This should be followed by practical exercises making maps or inventories of whatever things are available locally. The exercises should be repeated until the principles are well understood.

Only the simplest principles are discussed here. There are many more elaborate techniques for inventories and mapping that may be appropriate in particular situations. The references listed under supplementary materials can be used to expand this unit if necessary.

The principles of sampling referred to briefly in this unit are discussed in more detail in the section on techniques for research and monitoring (Unit H2).

EXERCISES

The first exercises should be done by the group leader as a demonstration. Then the participants should try the exercises themselves, repeating them as necessary until the principles are well understood. If the group is large, it may be better to divide it up into teams of two or three for the purposes of the subsequent exercises.

For the mapping exercises, first select an area like a sports field or the centre of a village that will be easy to map. Then a larger or more difficult area can be chosen. If there are already maps of these areas available, they can be used afterwards for comparison with those drawn by the participants.

If possible, there should also be exercises in making an estimate of a moving resource such as birds or fish, and a fixed resource such as a crop or certain forest trees.

It is always wise for the group leader to go through the field exercises first before presenting the unit to the group.

SUPPLEMENTARY MATERIALS

A simple but more complete description of surveying and mapping equipment and methods is given in: "Surveying and Mapping: A Manual of Simplified Techniques" by Robert F. G. Spier, published by Holt, Rinehart and Winston, Inc., New York, 1970.

For an introduction to the scientific literature on resource inventory methods, consult "Resource Inventory & Baseline Study Methods for Developing Countries" edited by Francis Conant et al. and published by the American Association for the Advancement of Science, Washington, D.C., 1983.

(Unit written by A. L. Dahl)
[Revision 10/09/85]

TEXT

RESOURCE INVENTORIES AND MAPPING

One of the first steps in managing something, whether a resource or anything else, is finding out where it is and how much there is. You cannot manage your pigs or chickens without knowing how many you have and of what age and sex, nor can you manage a bank account without knowing how much money is in it. In the same way, you must have some evaluation of an environmental resource in order to manage it. In a forest plot, you need to know how many trees there are, and of what kinds and ages. For an agricultural area, it is necessary to measure how much there is of each soil type, slope and exposure, and what these areas are capable of producing. Since water is often limiting, it helps to know how much is available and at what times of year. A fisherman would like to know how many fish there are if he wants to fish the resource sustainably. These measures do not have to be exact, but they should be close enough to give an estimate of how much is available and how it might be changing with time.

For many resources, the first step is to determine the area covered by the resource, usually by making a map of the area with its boundaries. A map is like a drawing or picture of the land taken from high in the air. It usually shows the coastline, mountains, rivers, roads, villages and other features of the land. It can also show resources such as forests, plantations and coral reefs. You can put many kinds of information on a map, such as what kinds of crops are grown in each field, how many cattle there are in each pasture, and where the best fishing areas are. This is one way of making an inventory, which is a quantitative list or description of your resources.

A map is usually made to scale. This means that some small measure on the map is the same as some large measure on the land. On a map of a whole country, 1 centimetre on the map might be 1 kilometre or 100 kilometres on the ground. For detailed local resource maps, an appropriate scale might be 1 centimetre on the map for 10 metres or 100 metres on the ground.

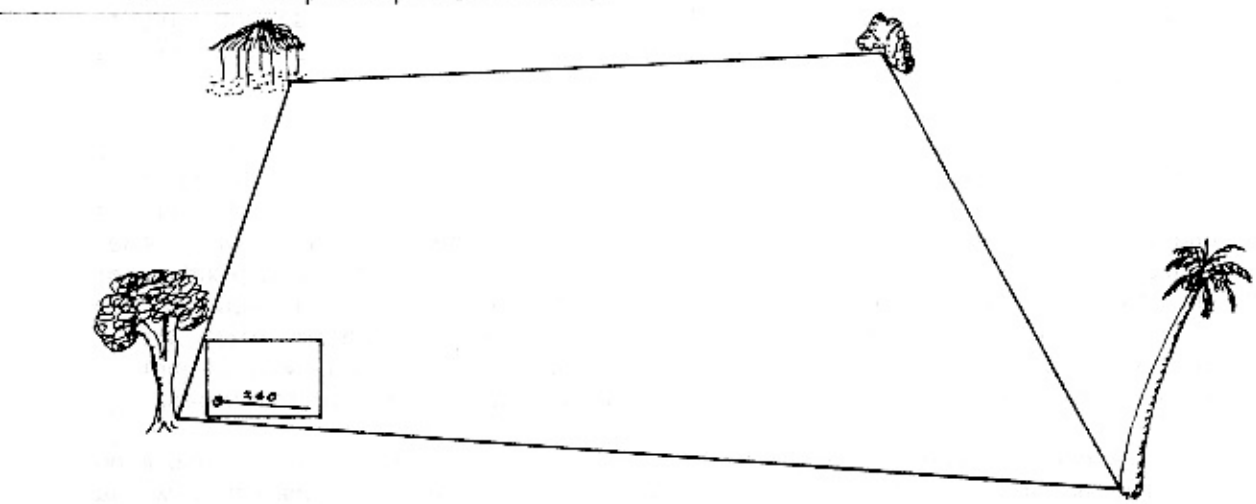
Sometimes there are existing maps available from the government or in the lands department from which the general outlines of your area can be determined. For marine areas, there may be nautical charts that give the outline of the reefs and lagoons. Aerial photographs may also be available, perhaps in some government department, from which the outlines of the areas can be traced. If it is possible to make at least a base map in this way, it will be easier to note the areas or boundaries of particular resources on it.

If no maps of your area are available, or if you need a more detailed map of certain places, then it will be necessary to make a simple one using one of the following methods.

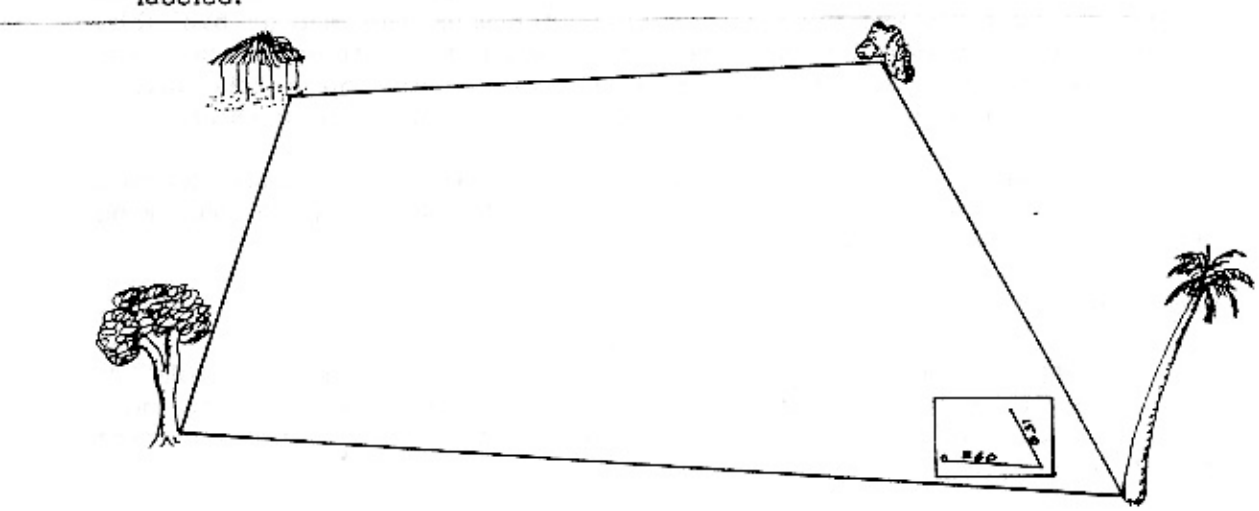
Sketch map

A simple rough sketch map can be made using only a pencil, a ruler or other very straight piece of wood or metal with regular markings on it, and a piece of paper on a board or other drawing surface that is flat and hard enough to write on.

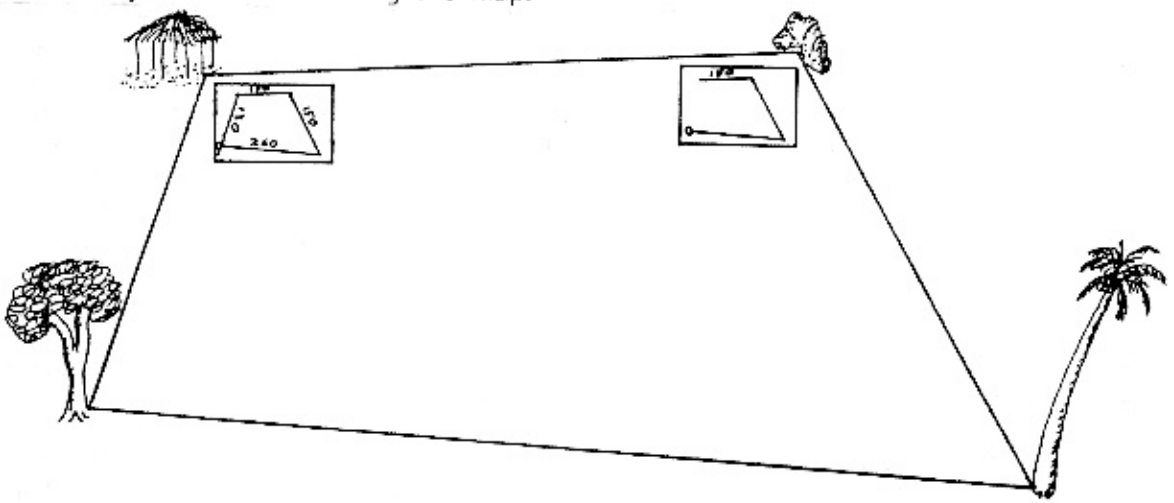
Look over the area to be mapped and decide what points, places or objects you need to locate on the map in order to draw in the important boundaries and features. These may be roads, rivers, buildings, boundary markers, large trees, the limits of watersheds, and other points of reference. Then choose the place where you are going to start making the map. This first point on the map is marked and labeled, and the board is set on the ground there. The ruler is laid on the board crossing through the first point. It is aimed at the second point by sighting along it, and a line is drawn. The distance from the first to the second point is then paced off, using steps of the same length and counting the steps. (Try pacing the same line several times to make sure your steps are the same length and the counts agree. This may take some practice.) The number of paces is written along the line, and the length from the first to the second point is marked on the line at an appropriate scale. For example, 260 paces could be 13 centimetres, for a scale of 20 paces per centimetre.



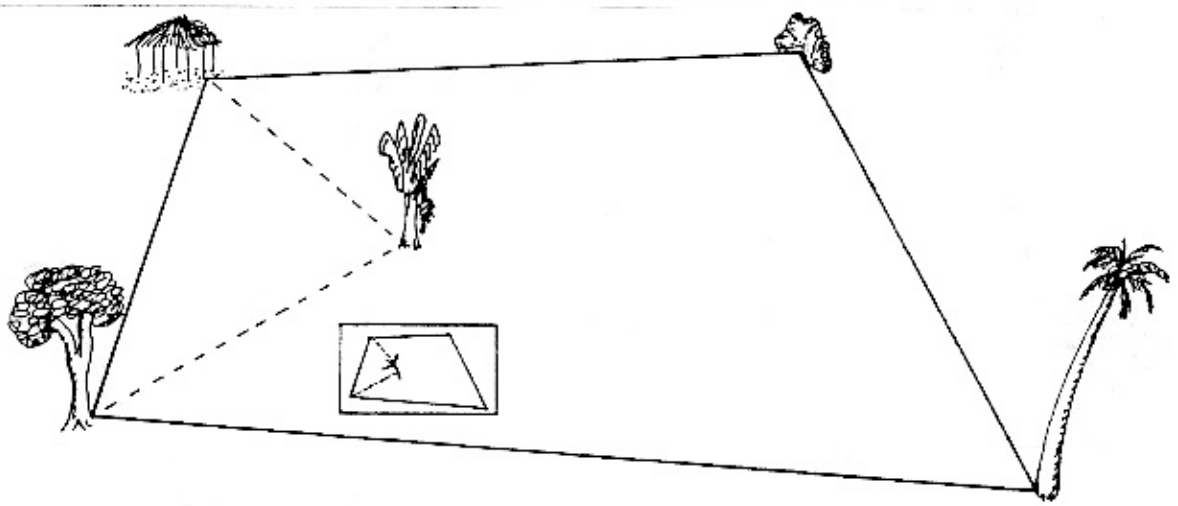
The board is then taken to the second point, laid on the ground, and oriented by sighting along the line drawn on the paper with the help of the ruler so that the line is lined up pointing back to the first point. Holding the board carefull so that it does not move, the ruler is then placed so that it crosses through the second point and is sighted at the third point. A line is then drawn, paced and measured as before, and the third point is marked and labeled.



At each corner or point along the boundary to be mapped, the board is placed on the ground and the same procedure is followed. If there is some error in closing the boundary when returning to the first point, it can usually be adjusted in redrawing the map.



If the area to be mapped is very large, it is best to subdivide it into smaller sections, map them separately, and then join the pieces of the map together. Other features to be added to the map that are not on the boundary lines can be added by sighting to them and pacing off the distance. If they are far off the line, it is best to sight and pace from two points on the line, forming a triangle, at the point of which the feature is marked.



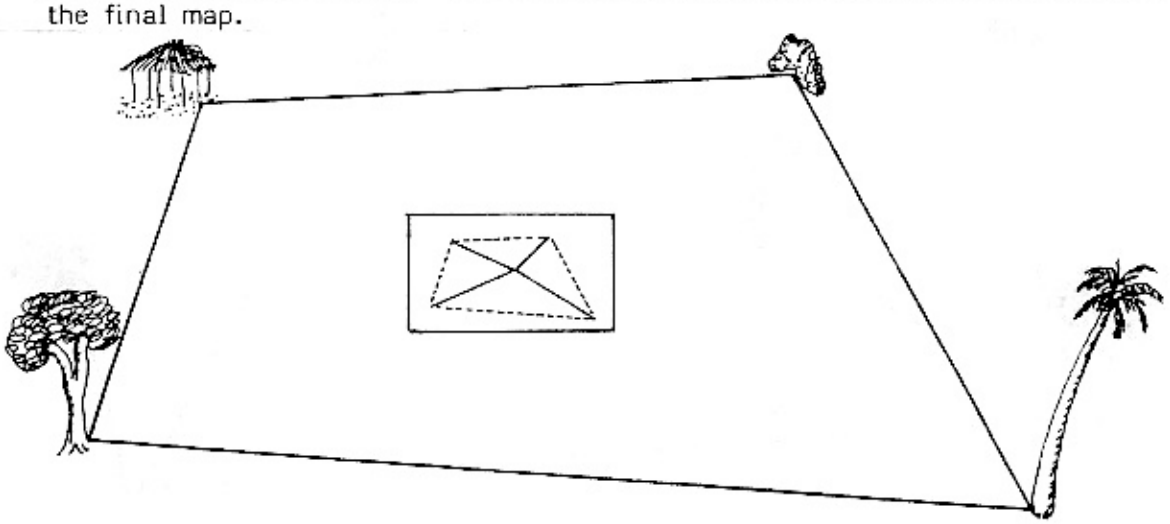
Plane table survey

If a more accurate map is needed, then it will be necessary to work with a flat (plane) table or board with a sheet of paper attached to it, a good ruler or alidade (a ruler with sights), and a measuring tape or other means of measuring.

The plane table should be sturdy so that it will not move during the survey, and it will need to be as horizontal as possible (a carpenter's level can help with this). A thick ruler or a ruler with sights (alidade) makes it easier to sight on points above or below the horizontal. The ruler needs some kind of regular markings or graduations so that you can scale the measurements. For measuring distances along the ground, a long tape measure of perhaps 30 metres is ideal. It can be laid end to end for longer distances. If a tape measure is not available, a rope (but not one that stretches like nylon) or a chain of known length can be used. You can even make a measuring rope yourself by taking a long piece of rope or heavy cord and tying knots at regular intervals of say 5 metres. Pacing can also be used if no alternative is available, but the map will not be as accurate.

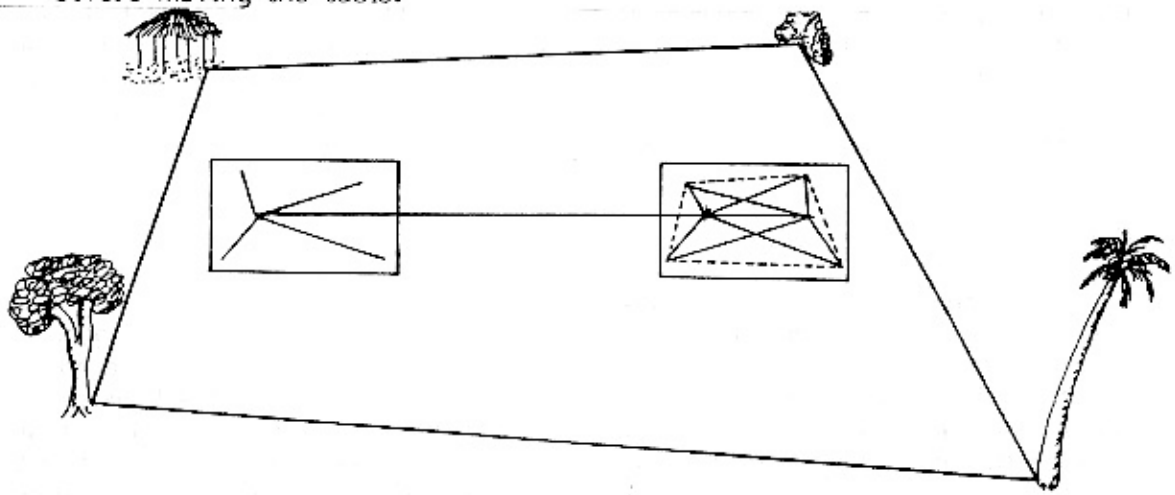
There are three methods of mapping with a plane table. The first is similar to the sketch map method shown above, with the table being moved from point to point around the boundary to be mapped. The improved equipment brings some improvement in accuracy.

In the second method, the table is placed either within or outside the area to be mapped at a point where all parts of the area can be seen. The position of the table is marked at an appropriate place on the paper, and lines of sight are drawn to each point to be mapped. It may be necessary to put a pole or stick at these points to make them easier to sight on. The distance from the plane table to each of these points is then measured with the tape or rope and marked with the ruler at an appropriate scale on the lines of sight drawn on the paper. The boundaries and labels are then added to make the final map.



The third method requires placing the table at two locations some distance apart. It must be possible to see all the points to be mapped, including the other location of the table, from both of these locations. The only measurement necessary is the distance between the two locations of the table, which should be shown by a line drawn to scale on the paper. This line is used to position the table at each location by sighting along it to the other location. While the table is at the first location with the baseline properly oriented, lines of sight are drawn toward each point to be mapped. These lines do not have to be measured or drawn to scale. The table is then moved to the other location and oriented by sighting back to the first location along the baseline. Lines of sight are again drawn to each of the points to be

mapped. The places where the two lines of sight cross are the positions of the points on the map at the scale of the baseline. Be sure to label these points before moving the table.



Once the positions of the major reference points have been located on the map, it should not be too difficult to draw in boundaries, important landmarks, and detailed features, and to add appropriate labels to make the final map. The sight lines used to prepare the map can be erased when they are no longer needed, or the map can be recopied in its final form.

These mapping techniques can be used for areas that are reasonably flat and of moderate size. The larger or more irregular an area is, the more points will be needed to map it properly; it may also be necessary to subdivide such areas and map the different parts separately. Simple mapping techniques are not practical for very large areas with distances too great to measure, or for forested or hilly areas where it is not possible to see the boundaries. For such areas, using an existing map and then adding local details may be the only solution.

Using maps for resource inventories

A map of your lands and waters will be very useful for planning how to use or manage your resources. By showing the position of each resource, it may help to show where to plan for development, and where to leave resources protected or undisturbed. Since a map is drawn to scale, it is possible to measure areas on the map and then multiply by the scale to get the actual area of each resource. You can thus calculate the total area covered by forest or coconut palms, or the area of shallow reef flats.

Measurements from a map are enough to evaluate some resources like the amount of agricultural land or the area of a water catchment. For other types of resources, the area covered may need to be combined with some other measure. The size of a taro crop depends not only on the area planted but also on how closely the plants are spaced. A count of a sample of the area may make it possible to estimate the resource for the whole area. For instance, suppose your map shows a large field 100 paces wide and 200 paces long planted in taro, and you want to know how many taro are growing in the field. It would take too long to count every taro, but if the taro seem to be

planted at the same density all over the field, you could count just a sample or small part of it. You would pace off a square of perhaps 10 paces by 10 paces (10 x 10 = 100 square paces) and count all the taro in the square. Since there are 100 x 200 = 20,000 square paces in the field and your sample is one two hundredth of this, you would multiply your count by 200 to get an estimate of the total number of taro. If you counted 120 taro plants in your sample square, there would be about 24,000 taro in the whole field. The same procedure can be used for forest trees, reef fish, or other resources.

Other inventory techniques

Not all resources can be evaluated on a map or in relation to a certain area, but they can sometimes be estimated along a line of known length, or over a set period of time. For instance, forest birds can be estimated by counting the number seen or heard while walking along say 1 kilometre of forest path at dawn, and trying to avoid counting the same bird more than once. Fish can be counted while swimming along a known length of reef front. Mosquitos can be evaluated by counting the number that come to bite you on the arm while sitting still for 15 minutes at nightfall. While these methods may not give total numbers, they can be repeated in exactly the same way to measure changes over time, such as the effects of heavy fishing or of spraying for mosquito control.

Estimates for a limited area can often be projected to the whole larger area of interest to give a value for the whole resource, as was done for the sample of the taro field above. Suppose that your village has 15 kilometres of shoreline with a fringing reef, and that there is no reason to think that there will be more fish on one part of the reef than another. If you have swum several times along 100 metres of reef edge, and each time you counted at least 3 large fish, then you can estimate the total number of such fish along the 15 km (15,000 metres) of reef at 3 x 150 = 450 fish. Knowing this, the village could plan on catching perhaps 50 to 90 such fish during the year and still leave a population able to reproduce and grow to a reasonable size (say 5 years old). The simple inventory has permitted a first step towards management. If you repeat the survey a year later and find that there are now fewer fish, then the village catch level may be too high and need to be reduced. This repeated measurement is monitoring of the resource to see how it may be changing.

The same type of inventories can be made for valuable trees in a forest, or for garden areas planted or resting in fallow. Making a complete inventory of the resources available to a village can help to suggest where development can take place and where resources are already being used to their limit, or even being pushed past their limit towards exhaustion.

QUESTIONS

What is the first thing you need to do in order to manage a resource?

What is a map? What does it show?

Are there already maps available for your area? If not, do you think it would be useful to make one?

Do you need complicated equipment to make a map? What do you need?

What kinds of resources can be shown on a map?

What resources would it be useful to map in your area?

What are some other techniques that can be used to estimate resources?

Why is it useful to repeat an inventory exactly the same way sometime later?

South Pacific Regional Environment Programme

Training Unit G2

THE ENVIRONMENT IN THE PAST

USE OF THIS UNIT

The environment is not just something in the present, it also has a history. This unit shows the importance of the past history of the environment to its present and future, and suggests different ways that the environment in the past can be deciphered. Since this history is different in each locality, the points raised in the unit should be used one after one as the basis for group discussion in which the participants share their own knowledge and experience. The discussion leader can also share examples of past changes in the local environment known to him or her.

If the group consists entirely of young people, it may be useful to bring in some older people to describe the local environment as it was in the past and how it has changed.

EXERCISES

If time permits, participants could be given individual projects to research information on the environment in the past from members of their family or village, or from documents or photographs in the library, museum and archives.

Field trips could also be planned to sites where there are visible signs of changes in the environment.

(Unit written by A. L. Dahl)
[Revised 15/09/85)

TEXT

THE ENVIRONMENT IN THE PAST

The environment was not always the way it is now. It has a history. You can learn a lot about your local environment by studying what it was like in the past and what has happened to make it the way it is today.

Some changes in the environment have been caused by natural events; many more are the result of things that man has done. It is useful to know what the environment was like in its natural state before man made any changes. It may also be interesting to know how man used the land or other resources in the past.

Knowing what used to be there is one way of knowing what the potential of the resource really is. If the land used to be covered by forest, you know that it is capable of supporting forest, even if it looks barren today. If a reef area was once a major fishing ground, it should be possible with careful management to make it so again unless man has so totally changed the area that conditions are now very different. If on the other hand an area has never had much vegetation, it is probable that some factor (irregular rainfall, poor soil type, etc.) has prevented a forest from growing, and agriculture or forestry will probably fail unless the limiting factor can be overcome, such as by irrigation.

Sources of information

Information about the environment in the past can be obtained from many different sources.

Old people may remember changes that have taken place in their lifetime, or that their parents or grandparents talked about.

Legends may make reference to fishing areas, to forests that were crossed, or to other resources or features now gone or disturbed.

Old photographs, etchings or paintings may show what an area looked like long ago.

Old aerial photographs taken during the war or used for map-making 20 or 30 years ago can provide valuable information on land use changes and wartime damage to the environment.

Early missionary diaries or traveller's narratives often include descriptions of the areas visited.

The reports of early scientific expeditions are now important as historical documents on the environment as well as for their scientific information.

Archaeological studies can reveal former village sites and agricultural areas, and often what were the predominant foods in local diets. Accumulations of seashells and fish and animal bones may show what occurred commonly in the past.

The land itself may show traces of its history, such as old tree stumps or the occasional banyan that could not be cut down when the forest was cleared. There may be occasional remnants of the former vegetation cover, or dead coral still in place on the reef.

Deposits of rocks, gravel, silt or coral rubble may show areas affected by floods, landslides or hurricane damage. What has happened once can happen again.

The nature of the forest or vegetation itself may tell what has happened to the land. Certain trees only regenerate very slowly in a forest; their presence shows that the forest has not been seriously disturbed for a long time. Other trees or plants grow very quickly after a disturbance; if they predominate the vegetation has regrown relatively recently.

There may also be signs showing how the resources were used or misused.

Terraces or mounds may show former sites of agricultural development.

Traces of irrigation or flood control works may show the need for water management.

Black scars on tree trunks or layers of charcoal or ashes in the soil may show where fires have destroyed the vegetation.

Patches of dead and broken coral may suggest that explosives have often been used for fishing.

Signs of erosion on the land such as washouts and gullies are signs of unwise clearing or overuse of the land.

The age of trees growing on a site may show approximately when the land was cleared or exposed, or when a former village site was abandoned.

Interpreting information on the past

If you learn to observe all these signs carefully, and perhaps to add others from your own experience, you will then be able to "read" the land and to understand something of its history. It may then be easier to decide how it can be used or developed, or what perhaps should be avoided because of the risks involved.

If the land shows signs of previous burning, then replanting trees may be unwise without firebreaks to prevent the spread of fires. If there is a ridge of storm-tossed rubble along the coast, then it would be better to build your house inland away from the reach of storm waves. Land that was cultivated traditionally may still have good agricultural potential.

Knowing the origin of certain present problems may also help in deciding how to correct them. If the water supply now runs short in dry periods, but the streams used to flow all year round when the hills were forested, then controlling land clearing and fires, and replanting the hillsides with trees may help to solve the water problem in the longer term. If abandoned terraces show that irrigation was necessary for successful traditional agriculture, then irrigation may also be needed for some modern crops to be successfully grown every year if the rainfall is variable.

QUESTIONS

Why is it useful to know the past history of the environment?

What can the past tell about the potential of environmental resources?

Have you heard old people talk about the environment in the past?

Do you know of old descriptions or pictures of your area?

Are there traces on the land that tell something about its past?

Does the land in your area show signs of damage?

Can you think of ways that former conditions can be restored to improve the environment where you live?

South Pacific Regional Environment Programme

Training Unit G3

PREDICTING THE FUTURE

USE OF THIS UNIT

Any plan or management action must be based not only on present conditions but on what is expected in the future. This unit introduces some of the scientific methods for predicting the future and the limitations of these methods. Each part of the text should be carefully explained to the group, using both the examples given and others which the group leader can develop using local situations. The ideas should be discussed until they are well understood by the group. This is not a topic that is easily reinforced by field visits or practice sessions, so the principles must be communicated through the leader's presentation and through examples developed with the group.

EXERCISES

One type of exercise which may help is that of imagining some particular time and place in the past, considering with the benefit of hindsight what actually occurred, and then asking whether and on what basis the people at that time could have predicted and prepared for the events that occurred. Try returning, for instance, to the time before some natural disaster such as a hurricane, flood or drought in your local area, and imagine whether the disaster could have been predicted at least in general terms, if not in its specific timing, and what steps people might have been able to take in the light of their predictions to minimize the damage.

(Unit written by A. L. Dahl)
[Revision 20/09/85]

TEXT

PREDICTING THE FUTURE

Any management of the environment is an attempt to change the course of future events to produce some desired result. You plant a crop because you expect a harvest, or build a house because you know it is going to rain and you want to keep your family and your possessions dry. A plan is similarly a description of what you expect or hope to happen if certain actions are followed. A house plan shows what the house will look like and what steps to take to build it. Planning and management are therefore concerned with the future, and they must be based on some idea of what is going to happen in the future.

It may seem hard enough trying to reconstruct what has happened to the environment in the past, but at least there are some concrete indications and signs available to help. Predicting the future is even more difficult, because no one knows for certain what will happen, and there can always be surprises. Some things like the changing seasons can be predicted with reasonable certainty, but even seasonal weather patterns may change from year to year. Other events such as the occurrence of an earthquake or the passage of a cyclone (hurricane) over a particular place may seem totally unpredictable in the present state of scientific knowledge in the region.

Those events, like the seasons, that are cyclical and occur at regular intervals, make it easier to predict some kinds of effects. Some cyclical events are the result of astronomical or celestial processes, such as:

day and night, the rising and setting of the sun;
the phases of the moon;
the tides;
seasonal changes over the year.

There are also many biological events associated in one way or another with these physical cycles. Some examples are:

the flowering and fruiting of many plants;
the breeding of some animals;
bird migrations;
some movements of fish around the reef.

Other events are random, that is they may occur at any time, and each occurrence has no relation to the preceding one. An example of a random event is flipping a coin to see if it comes up heads or tails (one side or the other); which side comes up is a random event. Such events could as easily occur twice in a row as not to occur at all for a long period. However random events can differ in the frequency of their occurrence. You can flip a coin many times or only a few times without having any effect on the random appearance of one side or the other. Some examples of random events are:

the accidental arrival of a new species on an island;
the path of a cyclone;
the place where lightning strikes.

Extrapolation

While the future can never be predicted with certainty, there are ways to have an idea of what is most likely to happen. One of these is called **extrapolation,** which means predicting what will happen in the future by projecting the trend of what has happened in the past and what is happening now. It is necessary to assume that the conditions that have occurred up to now will not change, or, it they do, that they will change in some known way that can be adjusted for. For instance, if a thousand hectares of forest have been cleared on an island every year for the past five years, you might extrapolate that five thousand more will be cut in the next five years. If each year the amount of forest cut increased, say by 500 hectares a year, you might expect the amount cut to go on increasing, assuming no change in conditions.

Extrapolations of Forest Clearing

	Known					Predicted				
Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Steady Cut	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Increasing Cut	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500

Most extrapolations have some limit beyond which they will not hold. If all the remaining forest will be cleared in three years, then cutting must stop at that limit if not before.

Population projections for some future time are usually based on an extrapolation from the past and present rates of population growth. They make it possible to plan for the number of schools to build, the number of jobs or houses that will be needed, and so on. However, if there is an unexpected change in the rate of population growth, then the extrapolated population figures will need to be revised.

Sometimes an extrapolation will show that a present trend must be changed. If 1,000 hectares of new agricultural land are being cleared every year, and there are only 10,000 hectares of good unused land left on the island, then by the end of ten years some alternative will have to be found to clearing more land, such as making better use of the land already cleared.

Extrapolations must be used with care, since sometimes the present trend itself will bring about changes in conditions, making the extrapolation false. In some places fishermen have been increasing their catch every year by adopting new fishing technologies, and an extrapolation from present trends would suggest that more investment in fishing equipment was worthwhile. But the new technologies may themselves lead to overfishing, producing a fall in the catch rather than an increase.

Many development projects have failed because they were based on overly optimistic extrapolations of the size of the resource or the production capability without a careful study of limiting factors.

Probability

Another measure useful in predicting the future is **probability**, which is the chance that something may happen in a certain period of time or during a certain number of events. In each flip of a coin, the probability of each side landing face upward is 50% (percent), and for each flip the probability is the same. The fact that the previous flip or even the previous 5 flips came up heads will have no effect on the probability of heads on the following flip. If records show that there has been a cyclone on the average approximately every 10 years, than the probability of a cyclone in any given year is 10%. Each year there is one chance in ten that there will be a cyclone, but over 10 years, the chance of having at least one cyclone approaches 100%.

Probabilities are used by insurance companies to calculate the cost of insurance. Based on past statistics say of automobile accidents, they calculate the probability of any one car having an accident to determine how much to charge each driver for insurance. If the company's calculations are correct, what it pays out for the few accidents that happen will be more than made up by what it receives from all the insured drivers.

While a probability estimate does not predict the future, it can give a measure of the possibility of something good or bad happening in a given period of time, and this makes it possible to estimate the chances of success or the risk of failure. It is then possible to include some provision in a project to cover these risks, just as an insurance company makes provision for its losses.

For example, suppose you are developing agricultural land in a river valley where the river is known to flood approximately every ten years. You thus know that there is a 10% probability each year that your plantings will be damaged by flooding, but you may feel it is worth the risk if the yield for the other 9 years will more than make up for the one year lost. However, this does not mean that you will have 10 years before the next flood. There is even a slight chance that there could be floods 2 years in a row, perhaps followed by a longer period without flooding. You might not build a house where there was a probability of flooding every 10 years, but you might in a place where the probability was only once in a hundred years.

Some probabilities can be calculated on the basis of what causes the event. In flipping coins, it is clear that there is an equal chance of each side landing upward. Others can be predicted on the basis of historical records, in which a probability is extrapolated from the frequency of past occurrences of an event. If records show that over the last 70 years and island was hit by 7 cyclones, then the annual probability of a cyclone can be calculated as 10%.

Using predictions of the future

No system for predicting the future will be right in every case or all of the time. The kinds of methods described here can increase the chances of being right and reduce the possibilities of a major error. They are therefore a useful part of the planning process.

It is important in using extrapolations or probabilities to evaluate not only the chances of success or failure, of good conditions or natural disasters, but also the consequences of being right or wrong. It is normal to accept a greater risk where the consequences are marginal than in situations that may be matters of life or death.

For instance, if you already have several fields under cultivation, you might take the risk of planting an area subject to flooding, because even if there is a flood, only a small part of your harvest would be lost. However, if you only could afford to plant one field, you would probably choose a safer place to avoid the risk of losing everything.

Similarly, a risk that would be acceptable for a crop or other agricultural development might not be acceptable for houses or school buildings. A 20% chance of damage might be acceptable for an annual crop, but not for a perennial crop like coffee. You would do everything possible to make a safe boat to transport your family, but probably less for a raft to transport building materials.

A relatively small probability of a major disaster may weigh more heavily in planning than a much greater risk of minor damage. A serious earthquake may occur only once in a hundred years or more, but failure to plan for it could lead to great loss of life.

Once a wise use of extrapolations and probabilities has been made using the best environmental information available, the challenge for environmental planning is to bring together this information with the best estimates of the consequences of various events and courses of action to arrive at plans that are reasonable, productive and safe.

QUESTIONS

Why is it useful to try to predict the future of the environment?

Is predicting the future based on magic or science?

What are some things that can be predicted easily?

What are some things that are very hard or impossible to predict?

What is meant by extrapolation into the future?

Can you give some examples of extrapolation?

What does a probability measure? Give an example.

How can probabilities be used in planning?

What is the annual probability of a cyclone or typhoon in your area?

What kind of natural disaster has the greatest probability where you live?

What preparations do people make for such future events?

Can you predict what your town or village will be like in 10 years time, using extrapolations and probabilities?

What do you think your own family will be like in 10 years? How many adults and how many children, and of what ages?

South Pacific Regional Environment Programme

Training Unit G4

PLANNING

USE OF THIS UNIT

This unit explains what a plan is and gives some of the basic principles of environmental planning. Many types of information that can be included in a plan are discussed, but participants should learn to be critical and selective in adapting the idea of planning to their own particular needs. It is much more important to learn the process of planning rather than the form.

At the local level, a plan can only work with community support, so methods for community participation in planning are discussed. This can first be tried within the group, and then possibly developed in a field exercise.

Participants must realize that making a plan is not just a goal in itself for the sake of having a plan, but that it is important to implement and monitor it. This should be discussed in the group at the end of the unit.

EXERCISES

Practical exercises in planning should be a major part of the unit. A first exercise could be undertaken by the whole group under the direction of the leader. Subsequent exercises could be done by small teams or individually. Choose local examples that the participants are familiar with, or that they can go and observe for themselves to get the necessary information. Examples should include both a physical plan for an area like a village, neighborhood or family land-holding, and a development plan for a resource or a small island. Avoid choosing a problem that is too large or complex, so that the participants do not get bogged down in details.

For the community participation section of the unit, it would be good, if circumstances permit, for participants to undertake a real field exercise in community planning. A project should be selected in co-operation with local authorities, such as the development of a village over the next 5 years, the siting of a new school or shopping area, the development of improvements in an urban neighborhood, the creation of a park or recreation area, etc. The participants should first study the problem and develop ways of explaining the problems and possibilities to the people concerned. They should then organize one or more meetings in the community at which a community solution to the planning problem is developed. The result should be written up and presented to the local authorities for possible implementation.

(Unit written by A. L. Dahl)
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TEXT

PLANNING

Many people simply decide that they are going to do something without thinking too much about the future. However it is much more effective to plan what you want to achieve and how you are going to do it. A plan is usually a written document, drawing or map that shows in advance what you want to do. Planning can also simply involve thinking out what you want to do, or perhaps consulting about it among the members of a family or the residents of a village. Planning makes it possible to identify problems before they happen or to see how one thing may interact with something else. It is then possible to work out solutions or make changes before going too far.

A person who is going to build a house usually plans how the house is going to look before he starts building; otherwise he may find that he has forgotten the door, or not made the wall strong enough to support the roof. In the same way, a family can plan how they are going to use their land, or a village can plan its development on the basis of all its available resources.

Governments and businesses often make economic development plans, in which they decide how much they want the economy or business to grow each year, and it what directions. They then usually work out what they have to do to achieve this. In a village, there is more often a need for a resource development plan which shows how resources can best be used, or a physical plan which shows how the village should grow or be laid out or how land and water resources uses should be arranged in the space available.

A plan is usually for a certain period of time, say 3 years or 5 years. It may be hard to make realistic plans for longer periods since things may change in unexpected ways. Sometimes a master plan for a town or land development may show how it will look after perhaps 20 years, or when the development project is finally completed.

A plan always has goals or objectives which show what you want to do or achieve at the end of the plan. It usually also has a description of how this is going to be done, often broken down into different steps or stages and perhaps with a time schedule giving the amount of time required for each stage.

Making a local development plan

A local development plan can help to make the best use of local resources. It can also help to identify and thus avoid environmental problems. Such a plan can be made by a family for its own land and resources, or by a village, tribe or district for its land and coastal waters.

The following steps can be followed in developing a local plan.

1. Collect as much **information** as possible on the resources and environment of the area. This is often simplest to do on a map or a series of maps, and may be the hardest part of making a plan. This information should include:

a. the size and shape of the area, its boundaries and coastline, showing mountains and flat places, streams, coral reefs, the separations between watersheds, and other topographic features;

b. the kinds of soil or rock on the land, and the type of bottom or coral reef in the sea;

c. where the water goes, including the outlines of the water catchments, streams, springs, wells, pipelines and other water supplies, the direction of runoff in storms, areas subject to flooding, etc.;

d. the living resources of the land and sea, such as forests, vegetation, gardens, pastures, degraded land, mangroves, seagrasses, corals, fish, birds and animals, etc.;

e. people, the things they have built and the places important to them: houses, schools, churches, buildings, roads, footpaths, powerlines, sacred sites, taboo areas, recreation areas and other features.

Some of this information may already exist on topographic maps, land use plans, geological or vegetation maps and other sources. It may not at first be sufficiently detailed for local use, but the detail can always be added by making observations on the site.

It is important to have not only the location of these features, but whatever information may be available as to the amounts, such as the population in each household or village, the amount of water, the areas of different crops, the number of fruit trees or coconuts, the catch of fish, etc.

2. Evaluate the **present land and resource use** in relation to the number of people who depend on the resources. For instance, how much land, reef, etc. is required per person to provide all their food, fuel, water, waste disposal, and other needs? It may be possible to calculate this from past and present experience. How much of the total available for each resource is now being used to meet these needs? What is already in short supply, or is being used in a way that cannot be sustained into the future?

3. Evaluate the **potential resources** that are available but not yet being used. Is there unused land, extra water, fish or other resources? How much agricultural land should be left in fallow to rest, and for how long? What is the need for conservation areas? What are the requirements for the sustainable use of resources?

Also evaluate the **needs** for resources. Is the population growing? What are the needs for increased income that can reasonably be met from the resource base?

4. The final step is to develop the objectives and recommendations of the **plan.** What resources can or should be developed, and in what order? What measures need to be taken to protect resources or to ensure their sustainability? Where will the new population, facilities, developments, and protected areas be located?

The overall goals can be broken down into stages, or into year by year plans for action. Intermediate steps can be worked out, and outside resources, finance or technical assistance that may be required can be identified.

The plan can then become a guide to immediate action with the assurance that the actions will build toward a well-defined objective and meet important needs.

Community participation in planning

A local plan will only be effective if it has the understanding and support of the community. The best way to get this support is to get everyone involved in making the plan together. People are more apt to support something if they know that their needs and ideas were listened to and incorporated where appropriate, and if they understand why certain needs could not perhaps be met. When the number of people is not too large, as in the case of most villages or small towns, ways can be found for people to participate directly in the planning process.

Local community planning will probably require a series of meetings of the people concerned. These could be held with everyone consulting together, or if necessary in smaller groups where everyone will feel free to express themselves (elders, young men, women, youth, etc.). If smaller groups are required, then someone will need to provide the link between the groups, exchanging needs and ideas. There may then need to be a final meeting of everyone at which the community consensus is worked out on the basis of everyone's inputs. Obviously any plan will need to have the agreement of any authorities with responsibility over the area concerned, such as the heads of families or chiefs, the council of elders, the mayor, or the village or island council.

At the start of the planning process, there will have to be an explanation of what planning is, why the local plan is needed, and what are some of the important principles to keep in mind. Specific examples can be used to supplement the ideas presented in these training units, or an audio-visual presentation on the subject could be developed if resources permit.

If a physical plan of a local area is being developed, it may help to first make a large map or model of the area, which can be drawn on a piece of paper, or even on a smooth area of sand or dirt. Houses and buildings can be symbolized by little models or blocks of wood, and roads by strips of paper. Make enough of these both for those that exist already and for those

that will need to be added during the period of the plan. People can then use the little models or the tracings in the sand to try out different placements and to visualize what their plan will look like, and this will make it easier to discuss the effects of the plan and to make comments and adjustments. When everyone is in agreement on the plan, or at the end of the meeting, someone should draw or write down the result. This will help to prevent later disagreement as to what was decided.

Such techniques allow everyone to participate in planning without any previous experience in planning concepts or procedures, although it may help to have the comments of an experienced planner to ensure that no important factors are overlooked. The result may even be better than that of an outside planner because it will be based on the intimate knowledge of the local environment contributed by the people who live there.

Implementing and monitoring

A plan is not an end in itself; if it is not put into practice it is worthless. Therefore some thought should be given to how the plan will be implemented. If the community is large enough, it may be necessary to give an individual or a body like a village or island council the responsibility for putting the plan into effect and seeing that its provisions are observed.

If the whole community has participated in the preparation of a plan, then there should be no real problem with its implementation. Everyone will be familiar with the plan and the reasons behind its provisions, and should thus want to put it into effect. If a plan has been developed by a smaller group, then it will need to be explained to those who are directly concerned by it. In particular, if the plan calls for them to stop or change some of their activities, they will need to understand why the changes are need and why it is in their own interest to follow the plan.

One danger is that a plan may be implemented initially, but then people start to forget about it and stop following it. Or conditions may change and the plan may seem less appropriate than it was at first. There may then need to be regular monitoring of progress made under the plan, and perhaps meetings to review progress and to consider the necessary modifications or updating.

All plans go out of date, and thus need to be revised or replaced with a new plan more suited to the changing circumstances, or building on the progress that was made in the previous plan. Revising a plan is similar to making a new one, except that there is already the information and experience from the earlier plan to build on.

These periodic reviews or revisions of a plan are also a good time to monitor trends in the loss or maintenance of environmental resources, and to identify changes and conflicts that require action or decisions. This can be an important contribution to the broader goal of managing environmental resources.

QUESTIONS

What is a plan?

Why is it useful to make a plan?

Who can make a plan?

What are some different kinds of plans?

What kind of plan would be most useful where you live?

Do you know of any plan already being used in your country?

What are the steps in making a plan?

Why is it good to have community participation in planning?

Why should a plan be monitored when it is implemented?