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PROGRESS REPORT OF THE WORK DONE ON LAND AT VINCHURNI LEASED FROM SHRI NIMBKAR. PERIOD COVERED : JULY 2001 TO JUNE 2003

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Introduction

Survey numbers 24 and 25 of Jadhavwadi, admeasuring 16 H. 41 R were leased to Ecological Society by Shri B. V. Nimbkar of Phaltan by an agreement concluded on 12th July 2001. It was decided that the lease should commence from 1st August 2001 with an annual rent of Rs. 6175/- The Society took over this land with the following objectives :

1. To study natural regeneration of vegetation in this semi-arid part of Maharashtra after due protection is given to the land.
2. To study the regeneration of indigenous grass species with a view to test the availability of good fodder.
3. To improve soil quality by application of eco-friendly measures.
4. To plant and introduce a variety of plant species indigenous and endemic to semi-arid areas with a view to conserve biodiversity.
5. To develop a grassland study and research centre for the benefit of students.
6. With the help of 2 barrages already existing, to create wetland conditions to attract waterfowl and regenerate wetland flora.

The Initial Inventory

An initial survey of the land carried out in July and August 2001 revealed that soil was poor in nutrients and humus and having a large mineral content. Initial inventory of plants showed 6 species of trees and 7 species of bushes covering the land. Trees were mainly Acacia sp. and Azadirachta indica while bushes belonged to Zizyphus- Cassia- Prosopis and Capparis species. Agave had been planted along the boundaries. Grasses were dominated by Heteropogon contortus and Aristida sp. that are known to be poor fodder. Six butterfly species were noted along with 29 bird species. Grassland and open area avifauna was represented by larks, partridges, quails, lapwings and Indian robin. Birds of the bushes included wren warblers and munias, doves and shrikes and bulbuls and sunbird. Arboreal birds included minivets and iora, parakeets and mynas, drongos and hawk-cuckoo, flowerpeckers and white-eye.

Beginning of Protection of the Land

As the Society took control of the land, a measure of protection could be given resulting in less incidence of grazing and cutting of vegetation. With the advent of rains, monsoonal wildflowers emerged. Six species of wildflowers were recorded during August 2001. One butterfly species was added to the initial inventory. Eleven bird species were recorded making the tally of birds 40. This list included 5 migratory species including the legendary Chatak. By October 2001 when rains ceased, 9 additional species of wildflowers were added. With protection a clear increase in biodiversity was therefore, evident.

The Emergence of Wetlands

With good rainfall two water bodies, viz. Upper and Lower Bhavani were formed behind the respective barrages. These shallow water-bodies were veritable wetlands attracting waterfowl such as herons and ducks and waders such as snipes and sandpipers. Egrets and three species of kingfisher were also recorded. Lower Bhavani dried up by end of December 2001 while water in the Upper Bhavani remained till February 2002. As wetland plants and aquatic vegetation was scarce in the vicinity, there was no regeneration of these plants and the herb *Heliotropium* covered the drying substrate of Upper Bhavani as water evaporated. As long as water remained, birds such as ducks, doves, larks and quail could breed in the vicinity.

Revival of Grasses

Grasses ripened by November 2002 and besides *Heteropogon* and *Aristida*, several other species such as *Eragrostis*, *Sporobolus*, *Chrysopogon*, *Lophopogon* and *Andropogon* were recorded. With protection and control over grazing, grass species regenerated, the number of species going up from 2 to 7. However, the regeneration of grasses was mainly of species having inferior fodder value.

Some Management Measures

To strengthen protection and facilitate regeneration, an electric fence was installed around 20 acres of land which included the two barrages in December 2001. This effectively controlled grazing and other human interference. Waste material from Shri Nimbkar's goat farm was spread at some places inside the fence to provide biomass cover to the land and induce microbial activity. Geophysical investigations were carried out in April 2002 to find out if underground water could be a source of water. An area was marked where water could be struck. However, boring up to a depth of 100 feet did not obtain any water. It was advised that it was necessary to go down to a depth of 200 feet or more to obtain a daily supply of 10,000 to 12,000 litres in summer. A large cistern with a capacity of 10,000 litres was constructed to store water.

The Rainy Season of 2002

Middle of June 2002 saw return of rains which partially filled up Upper Bhavani. A number of monsoon herbs (9) regenerated. In a few days their number went up to 17. Some fruit such as Tamarind, *Phyllanthus* and Kavath were planted. Also 55 saplings of Khejadi (*Prosopis cineraria*) obtained from the Social Forestry Department were also introduced. A variety of Bor (*Zizyphus*) species was also introduced. The other seeds scattered within the fenced land included *Parkinsonia*, *Hardwickia* and *Acacia catechu*. A legume, *Stylo haemata* was also planted. Most of the seeds germinated. In the marsh below Upper Bhavani, some marsh plants collected from Pune were introduced. *Parthenium* proved to be a troublesome weed and had to be manually removed.

Very little rain fell in July and August and the germination and growth of seedlings and saplings seemed to have stalled. There was some rain during the last week of September and the first week of October but it was not sufficient to fill up Upper and Lower Bhavani. Though we had taken pains to create islands in Upper Bhavani and a band of impervious material was laid on the ground to reduce percolation from the wetland, water did not collect due to inadequate rainfall. This however, did not deter the growth of grasses.

Re-emergence of Fodder Grasses

In 2002 the number of grass species went up from 7 to 22. A number of good fodder grasses such as *Dicanthium* sp., *Iseilema* sp., *Eragrostis* sp. germinated showing that the control on grazing leads to regeneration of grasses that are preferred grazing for cattle and sheep and hence are eliminated if grazing was unchecked. The number of herbs went up from 17 to 30. With very good grass cover, the fenced plot stood out as the surrounding land with unchecked grazing and cutting quickly became parched and looked degraded with the beginning of the dry season. As Upper Bhavani dried up, the growth of *Heliotropium* which was evident last year, was replaced by a profuse growth of *Eragrostis*, a good fodder grass.

With very good grass cover a number of birds built nests in our plot. They included Spotbill duck, doves, quails, lapwings and animals such as hare.

With the onset of dry season in November, biomass in the form of waste material from the goat farm was spread once again to conserve moisture. Saplings had to be watered by bringing water in tankers. Weeds such as *Parthenium* and *Alternanthera* had to be removed manually. Grazing was allowed in the area outside the fence as the local people faced shortage of grass and other forage.

Educational Activities

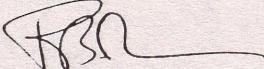
Students of our one-year post graduate course in sustainable management of natural resources and nature conservation are given practical training in grassland flora and its management on this land. In 2001 and 2002 two training camps were held for these students in November when grasses ripen, flower and are easier to identify. Local students from schools in Phaltan also visited our land to see flora and fauna, especially birds.

Concluding Remarks

As the 2nd year is drawing to a close, we have the satisfaction of initiating the process of natural regeneration of grasses, herbs and witnessing the healthy growth of existing trees. The species planted or introduced are on the whole, doing well in spite of the failure of rains in 2002. The objective of developing a study-cum-demonstration centre for school and college students has been largely achieved. The fenced and unfenced plots have already become havens for birds, monitor lizards and other wildlife.

If rainfall revives in 2003, the process of regeneration will be strengthened, wildlife will be more permanent, wetland flora will regenerate, waterfowl will return and better quality grasses and fodder will be increasingly available.

July 10, 2003


Director, Ecological Society.

Annexure : List of Recorded Plants, Butterflies and Birds

List of trees

Dalbergia sissoo
Acacia auriculiformis
Azadirachta indica
Tamarindus indicus
Tecoma stance
Ailanthus excelsa
Parkinsonia sp.

Acacia nilotica
Albizzia lebbeck
Acacia leucophloea
Acacia catechu
Citrus nimonia
Hardwickia pinnata
Zizyphus jujuba

Bushes

Zizyphus numularia
Agave americana
Fluggea sp.

Cassia auriculata
Capparis decidua
Solanum verginianum

Grasses

Melanosynchrus sp.
Eragrostis sp.
Pseudanthestia heteroclita
Setaria cumillia
Eragrostis viscosa
Sporobolus sp.
Eleocharis sp.
Themeda sp.
Sporobolus indicum
Lophopogon tridentatus
Chrysopogon sp.
Dicanthium annulatum
Erimopogon seabolotus
Bothrichloa sp.
Andropogon sp.

Heteropogon contortus
Aristida sp.
Aristida adsensionis
Dactiloctenium aegypticum
Astraxon sp.
Tripogon sp.
Saxiolepis sp.
Chrysopogon fulvus
Aristida stocksii
Andropogon pumilus
Pennisetum sp.
Brachiaria reptans
Fimbristylus sp.
Eragrostis japonica
Iseilema anthesonoides

Herbs

Tribulus terrestris
Hypoxis aurea
Lepidagathis cristata
Chlorophytum tuberosum
Blumea lasera
Argemone mexicana
Centorium meyeri
Pentanema indicum
Amaranthus sp.
Rizophora sp.
Polycarpa sp.
Polygala sp.
Phylla nudiflora
Caraleuma fimbriata

Evolvulus alsinoides
Cynotis tuberosa
Justicia sp.
Boerhaavia repens
Tridax procumbence
Cyathocline purpurea
Verbascum chinens
Chrysophora sp.
Euphorbia rosea
Commelina sp.
Mollugo hirta
Heliotropium sp.
Killynga triceps

Climbers

Cryptostegia grandiflora
cucurbitaceae

Rivea hypocrateriformis

List of Butterflies

Common pierrot:
Plain tiger:
Orange tip
Common Emigrant:
Common rose:
Lemon pansy:
Blue pansy:
Baronet:
Tailed jay:
Mottled Emigrant:
Common mormon:
Joker:
Lime:

Castalius rosimon
Danaus chrysippus
Ixias marianne
Catopsilia pomona
Pachliopta aristilochiae
Junonia lemonias
Junonia orithya
Euthalia nais
Graphium agamemnon
Catopsilia pyranthe
Papilio polytes
Biblia ilithya
Papilio demolius

List of birds:

Pied bush chat
Black bellied finchlark
Rufoustailed finchlark
Yellow wattled lapwing
Common nightjar
Little brown dove
Grey partridge
Grey shrike
Spotted munia
Indian skylark
Red wattled lapwing
King crow
Common myna
Large grey babbler
Blue cheeked bee-eater
Paddy field pipit
Bay backed shrike
Rufousbacked shrike
Spotbill duck
Green sandpiper
Intermediate egret
White wagtail
Rosy pastor
White throated munia
Pied kingfisher
Bonelli's hawk eagle

White eye
Indian wren warbler
Ring dove
Purple sunbird
Weaver bird
Plain wren warbler
Rock bush quail
Little minivet
Sykse's crested lark
Iora
Indian robin
Redvented bulbul
Hawk-cuckoo
Blossom headed parakeet
Red turtle dove
Pied crested cuckoo
Singing bushlark
Pale harrier
Snipe
Grey heron
Cattle egret
Yellow wagtail
Spotted munia
Bhyth's reed warbler
Small blue kingfisher
Ashy crowned finchlark

Large grey babbler
Rose-ringed parakeet
Painted partridge
Shikra
Small green bee-eater
Hoopoe
Barn swallow
Longtailed shrike
Large billed crow
Clamorous reed warbler
Common sandgrouse

Collared dove
White eyed buzzard
Short toed eagle
Common kestrel
Laughing dove
Indian bushlark
Wire tailed swallow
Black drongo
Plain prinia
Silverbilled munia

**PROGRESS REPORT OF THE WORK DONE ON LAND AT JADHAVWADI in
collaboration with NARI**

PERIOD COVERED : JULY 2003 TO JUNE 2005

Introduction

The Ecological Society started restoration work in Survey No. 24 and 25 of Jadhavwadi, Vinchurni. The society work over this land with the following objectives.

- a) To study natural regeneration of vegetation in semi - arid part of Maharashtra.
- b) To improve soil quality.
- c) Conservation of biodiversity.
- d) To develop a grassland study and research Centre.
- e) To create wetland condition to attract waterfowl and regenerate wetland flora.
- f) To study insects, their host plants and predators, their role in grassland eco-system.

Work done in June 2003 - 2005

- 1) A hand pump has been installed on the tubewell. This has made possible raising of a nursery of semi-arid region plants on the site.
- 2) Farm pond pitching was done to increase water storage capacity and reduce percolation of water from pond.
- 3) Spreading of a sticky clay in upper and lower Bhavani to increase water storage and period of water availability.
- 4) For the purpose of increasing biomass and soil fertility we spread grass in upper, lower Bhavani and area with less biomass (rocky area). This also helps to increase water holding capacity of soil.
- 5) Dormitory extension, seating arrangement and Nursery development.
- 6) Monitoring: Setting up permanent quadrates to study insects on the site to gauge their diversity and role in the grassland eco-system.
- 7) Labelling of different grass patches.

Wetland :

In 2003 failure of rains caused shortage of water in our water bodies, Viz. Upper, Lower Bhavani and Farm pond. But in 2004 with good rainfall water remained in both upper and lower Bhavani till Feb. 2004, while water in farm pond remained till April 2004. A sticky clay was spread in upper and lower Bhavani to prevent water percolation and to increase water availability. Mulching with grass helped to increase biomass and aquatic vegetation. As long as water remained birds attracted to wetland. In between Upper Bhavani and Farm pond, 125 X 106 Feet marsh area was developed naturally.

Trees, Shrub, Herb, Climber :

Healthy growth of existing trees and regeneration of *Azadirachta* sp. is good. Planted seedlings of Tamirind, Khejadi, Kavath, Avala, Parkinsonia, *Acacia catechu* is healthy and good growth. Number of birds built nests in trees near water bodies and clumps of *Acacia*, Bor. Agave had been planted along the boundaries is very good growth condition, next 3-4 year has become a live fencing. Tree flora is same to compare 2003. New shrub sp. recorded are *Abutilon indicum*, *Calotropis gigantea*, *Puccinia lapacea*. Good growth and regeneration of shrub *Alysicarpus* sp. near Farm pound edge. *Alysicarpus* is a nutritive fodder sp. Quantitative herb sp. reduced but diversity of herb flora increased. In 2003 - 05, 43 sp. recorded, new sp. are *Taverniera* sp., *Physalis minima*, *Tragia*, *Phaseolus*, *Corchorus*.

Grasses :

Grassland are ecologically sensitive and fragile areas, which have to be managed with great care. Grasslands are also important as reserves for important wild species, birds, reptiles and mammals. By destroying the grasslands one may run the risk of driving a few more wild species towards extinction.

As a result of protection and control over grazing in our land grass species regenerated, nutritive and fodder valuable grasses is well developed they includes perennial grasses such as *Amphilopis*, *Chrysopogon*, *Sahima*, *Dicanthium*, *Themeda*, *Iseilema*. These grasses observed only in fence area. *Heteropogon contortus*, *Lophogon tridentatus*, *Aristida* sp. and *Melanocenchris* sp. are observed dominant in unprotected area. 42 Grass sp. recorded in our project land.

Recorded Trees, Shrub, Climbers and Herbs

Trees	Shrub, Climbers	Herbs	Herbs
1. <i>Acacia nilotica</i>	1. <i>Agave americana</i>	1. <i>Argemone mexicana</i>	28. <i>Justicia sp.</i> 24
2. <i>Acacia catechu</i>	2. <i>Abutilon indicum</i>	2. <i>Amaranthus sp.</i>	29. <i>Lepidagathis cristata</i>
3. <i>Acacia leucophloea</i>	3. <i>Cassia auriculata</i>	3. <i>Alysicarpus sp.</i>	30. <i>Lavendulla sp.</i>
4. <i>Acacia auriculiformis</i>	4. <i>Cassia sp.</i>	4. <i>Borivia diffusa</i>	31. <i>Monosonia senegalensis</i>
5. <i>Azadirachta indica</i>	5. <i>Capparis decidua</i>	5. <i>Borivia repens</i>	32. <i>Mollugo hirta</i>
6. <i>Albanthus excelsa</i>	6. <i>Dichrostachys cinerea</i>	6. <i>Chlorophytum tuberosum</i>	33. <i>Pentanema indicum</i>
7. <i>Albizia lebeck</i>	7. <i>Fluggea sp.</i>	7. <i>Centorium meyeri</i>	34. <i>Polycarpa sp.</i>
8. <i>Citrus nimonia</i>	8. <i>Lantana camara</i>	8. <i>Cleome sp.</i>	35. <i>Polygala eureptera</i>
9. <i>Dalbergia sissoo</i>	9. <i>Mimosa hamata</i>	9. <i>Celosia argentea</i>	36. <i>Phylla nudiflora</i>
10. <i>Parkinsonia sp.</i>	10. <i>Calotropis gigantea</i>	10. <i>Cynotis tuberosa</i>	37. <i>Physalis minima</i>
11. <i>Tamarindus indicus</i>	11. <i>Puppalia apacea</i>	11. <i>Cyathocline purpurea</i>	38. <i>Pulicaria vitiana</i>
12. <i>Tecoma stance</i>	12. <i>Solanum verginianum</i>	12. <i>Chrysophora sp.</i>	39. <i>Rizophora sp.</i>
13. <i>Zizyphus jujuba</i>	13. <i>Cocclus hirsutus</i>	13. <i>Commelina sp.</i>	40. <i>Tribulus terrestris</i>
14. <i>Hardwickia pinnata</i>	14. <i>Cryptostegia grandiflora</i>	14. <i>Evolvulus alisinoides</i>	41. <i>Tridax procumbence</i>
	15. <i>Cucurbitaceae</i>	15. <i>Euphorbia rosea</i>	42. <i>Taverniera sp.</i>
	16. <i>Cucumis sp.</i>	16. <i>Euphorbia hirta</i>	43. <i>Tragia sp.</i>
	17. <i>Crotalaria sp.</i>	17. <i>Euphorbia geniculata</i>	44. <i>Striga sp.</i>
	18. <i>Rhus mysorensis</i>	18. <i>Hypoxis aurea</i>	45. <i>Crotalaria sp.</i>
		19. <i>Indigofera cordifolia</i>	46. <i>Blumea sp.</i>
		20. <i>Indigofera linifolia</i>	47. <i>Launea procumbens</i>
		21. <i>Trientema sp.</i>	48. <i>parthenium</i>
		22. <i>Phyllanthus niruri</i>	49. <i>Ocimum canum</i>
		23. <i>Phaseolus</i>	50. <i>Vernonia</i>

		<i>subloatus</i>	<i>cinerea</i>
		24. <i>Heliotropium ovalifolium</i>	51. <i>Pimpinella monoica</i>
		25. <i>Solanum virginianum</i>	52. <i>Alternanthera sessilis</i>
		26. <i>Lagasca mollis</i>	
		27. <i>Solanum nigrum</i>	

Recorded grass species and distribution

✓ 1. <i>Amphilopis sp.</i>	- Perennial, nutritive grass. Good cover developed in between Upper Bhavani and Farm pound. Found only in fence area.
2. <i>Andropogon pumilus</i>	- Scattered all over, less in population.
3. <i>Apluda mutica</i>	- Perennial grass, observed only in fence area. Less in population
4. <i>Aristida adsensionis</i>	- Perennial grass, less nutritive. Found in rocky area in fence. Unfenced area it is observed in dominant.
5. <i>Aristida sp.</i>	- Found in rocky area in fence, unfenced area it is dominant.
6. <i>Astraxon sp.</i>	- Found in rocky area in fence.
7. <i>Aristida stocksii</i>	- Found in rocky area in fence, unfenced area it is dominant.
8. <i>Apluda aristata</i>	- Perennial grass, less in population. Present both area.
9. <i>Arundinella sp.</i>	- Less population, present both area.
10. <i>Bothrichloa sp.</i>	- Less in population.
11. <i>Brachiaria reptans</i>	- Less in population.
✓ 12. <i>Chrysopogon montanus</i>	- Perennial grass, tall 5 - 6 feet. Found only in fence area. Good cover in protected area.
✓ 13. <i>Chrysopogon fulvus</i>	- Perennial grass, observed both area.
14. <i>Chloris</i>	- Less population, observed both area.
15. <i>Cenchrus</i>	- Annual grass, Found only in fence area.
16. <i>Cyanodon dactylon</i>	- Perennial grass, found in fence area, less in population.
✓ 17. <i>Dicanthium annulatum</i>	- Perennial grass, observe in fence area.
✓ 18. <i>Dicanthium aegypticum</i>	- Perennial grass, observe in fence area.
19. <i>Digitaria sp.</i>	- Annual grass, observe in fence area, less in population.
20. <i>Dinebra retroflexa</i>	- Annual grass, observed only in fence area, near Upper Bhavani black soil area.
✓ 21. <i>Eragrostis viscosa</i>	- Annual grass, found both area.
22. <i>Erimopogon seabolotus</i>	- Found fence area, less.
23. <i>Eragrostis japonica</i>	- Annual grass, found both area.
✓ 24. <i>Heteropogon insignii</i>	- Perennial grass, tall grass 8- 10 feet high. Good cover in fence area, rare in unfenced area.
25. <i>Heteropogon contortus</i>	- Perennial grass, Observed both areas but dominant in unfenced area.
✓ 26. <i>Iseilema sp.</i>	- Perennial grass, tall 5 - 6 feet. Good cover in fence area. Absent in unfenced area.

27. <i>Lophopogon tridentatus</i>	- Found both area .Observed rocky area in fence, unfenced area it is dominant.
28. <i>Leersia sp.</i>	- Perennial, aquatic. Found near wetland.
29. <i>Melanosynchrus sp.</i>	- Rare in fence area but it is more in unfenced area .
30. <i>Panicum sp.</i>	- Perennial grass , observed both area, less in population .
31. <i>Paspalum sp.</i>	- Annual grass, observe only in fence area near upper Bhavani .
32. <i>Setaria glauca</i>	- Annual grass, found in fence area .
33. <i>Sehima nuvrosum</i>	- Perennial grass, good cover in fence area but rare in unfenced area .
34. <i>Ischaemum sp.</i>	- Observe in fence area, less in population .
35. <i>Sporobolus sp.</i>	- Found both areas .
36. <i>Sporobolus indicum</i>	- Found both areas .
37. <i>Saxiolepis sp.</i>	- Observe in fence area, rare .
38. <i>Themeda</i>	- Found in fence area only, near Lower Bhawani edge.
39. <i>Tripogon sp.</i>	- Found both areas .
41. <i>Pennisetum sp.</i>	- Found in fence area.
42. <i>Fimbristylus sp.</i>	- Found wetland area in fence .

Analysis of the Insect Data:

Insect are among the first animals to arrive at a denuded, degraded site. Insect diversity studied various tropic levels gives us an idea about flow of energy and cycle of nutrients

Invertebrate Fauna Species List

I.Odonata

1. *Brachythemis contaminata*
2. *Orthetrum cancellatum*
3. *Ceriagrion olivaceum*
4. *Bradinopyga geminata*
5. *Trithemis festiva*

II.Orthoptera

1. *Arida lugubris*
2. *Pyrgomorpha brachycera*
3. *Stauroderus sp.*
4. *Gastrimargus marmoratus*
5. *Melanopus sp.*
6. *Locusta danica*
7. *Dociostaurus sp.*
8. *Aealopus tamulus*

III. Gryllodea

1. *Gryllus domesticus*
1. *Gryllodes sagillatus*

IV. Phasmida

1. *Necroskia folidotus*

V. Mantodea

1. *Defyobe sp.*

VI. Blattaria

1. *Blatta orientalis*
2. *Supella longipalpa*

VII. Isoptera

VIII. Neuroptera

1. Myrmelion sp.

IX. Lepidoptera

1. Lime butterfly
2. Common Rose
3. Pioneer
4. Common Gull
5. Common Grass yellow
6. Small Grass yellow
7. Mottled Emigrant
8. Indian Cabbage White
9. Yellow Orange Tip
10. Tawny Coster
11. Joker
12. Common Leopard
13. Common Castor
14. Yellow Pansy
15. Blue Pansy
16. Lemon Pansy
17. Chocolate Pansy
18. Painted Lady
19. Danaid Eggfly
20. Glassy Tiger
21. Blue Tiger
22. Plain Tiger
23. Striped Tiger
24. Common Crow
25. Common Pierrot
26. Rounded Pierrot
27. Zebra blue
28. Pale grass Blue
29. Tiny Grass Blue
30. Gram Blue
31. Pea blue
32. Common Silverline
33. Indian Skipper
34. *Diopia pulchella*
35. *Trigonodes hypasea*
36. *Eublemma sp.*
37. Noctuidae

38. Micromoth
39. *Sauris sp.*
40. *Clania cranieri*

X. Hymenoptera

1. Ponerinae
2. Myemecinae
3. Camponotinae
4. *Apis indica*
5. *Apis dorsata*
6. Other Bees
7. *Xylocapa fenestra*
8. *Ramenes sp.*
9. *Polistes sp.*
10. *Scalifron sp.*
11. Ichneumenoidae - *Cheyris obliterated*

XI. Diptera

1. *Musca domestica*
2. *Musca nebado*
3. *Culex sp.*
4. Scorpion fly
5. *Sarcophaga sp.*
6. Calliphoridae
7. Robber fly
8. *Agromyza sp.*
9. Gall fly
10. *Siphonellea funicola*
11. Midges
12. Fruit flies
13. Moth fly

XI. Hemiptera

1. Aphids
2. Membracidae (cow bugs)
3. *Urybrachis tomentos*
4. Spittle Bug
5. Coccidae
6. *Belastoma sp.*
7. *Jassidae*

XII. Coleoptera

1. 6-Spotted Ladybird
2. 8-Spotted Ladybird
3. *Platynotis sp.*
4. Scarabs
5. *Heliocarpus sp.*
6. Stem Borers
7. Blister Beetles

XIII. Other Arthropods

A. Myriopoda

1. Millipede-2 species
2. Centipede-1 species

B. Arachnida

1. *Mesobuthus fumulus*
2. *Cryptophora citricola*
3. *Neoscona sp.*
4. *Lycosa sp.*
5. Megalomorph
6. Salticidae-2 species
7. Clubionidae-1 species
8. Pisauridae-1 species

XIV. Annelida

Earthworm

Tropic levels

Primary Consumers

A) Herbivorous

1. *Acrida lugubris*
2. *Pyrgomorpha brachycera*
3. *Stauroderous sp.*
4. *Gastrimargus marmoratus*
5. *Locusta danica*
6. *Dociestaurus sp.*
7. *Melanopus sp.*
8. *Aealopus tamulus*
9. *Gryllus demesticus*
10. *Gryllodes sagillatus*
11. *Necroskia folidotus*
12. Gall fly
13. Midges
14. Fruit fly
15. Moth fly
16. Aphids - Jassidae
17. Membricidae
18. *Urybrachys tomentorus*
19. Spittle bug
20. Coccids
21. 6 spotted ladybird beetles
22. 8 spotted ladybird beetles
23. *Platynotis sp.*
24. Stem borus
25. Blister beetles
26. Isopterans

B) Nectar feeders

1. Lime butterfly
2. Common Rose
3. Pioneer
4. Common Gull
5. Common Grass yellow
6. Small Grass yellow
7. Mottled Emigrant
8. Indian Cabbage White
9. Yellow Orange Tip
10. Tawny Coster
11. Joker
12. Common Leopard
13. Common Castor
14. Yellow Pansy
15. Blue Pansy
16. Lemon Pansy
17. Chocolate Pansy
18. Painted Lady
19. Danaid Eggfly
20. Glassy Tiger
21. Blue Tiger
22. Plain Tiger
23. Striped Tiger
24. Common Crow
25. Common Pierrot
26. Rounded Pierrot
27. Zebra blue
28. Pale grass Blue
29. Tiny Grass Blue
30. Gram Blue
31. Pea blue
32. Common Silverline

Chairman
Vice Admiral M. P. Awati
PVSM, VrC

Director
Prakash Gole

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Progress Report of the work done on land at Jadhavwadi in collaboration with NARI during the year 2006 (1st January 2006 to 31st March 2007)

Introduction

In the previous reports of work done on this land and progress achieved, the increase in the number of species of grasses & shrubs and the regeneration & growth of trees have already been noted. The qualitative improvement of grasses has been noted also. The total biomass in the area shows a significant improvement during 2006 as a result of adequate & widespread rainfall (more than 400 mm during the year).

The improvement in Biomass

To get some quantitative idea of the biomass, one square meter quadrats were laid out in the grassland and grass growing in each square was clipped at ground level and weighed. The results are given in the table at the end of the report. It shows a biomass weight of 7 to 8 tonnes per hectare in the protected area.

It may be noted here that a representative hectare in unfenced area is almost pure grass species while a representative hectare in the fenced area has more cover types and is therefore more of a savanna biome than pure grassland. Now a days grassland has value not only in terms of fodder but also in terms of its potential as biofuel. The per hectare weight of grass species has importance in this context.

Soil Quality

It can be presumed that soil quality i.e. crumb structure and nutrient content should have improved due to protection & cessation of uncontrolled grazing in the area. We collected soil samples from the fenced as well as the unfenced area. Besides crumb structure, nutrient content & moisture holding capacity, we wanted to assess the soil for its microbial activity such as nitrogen fixation etc. The samples have been sent to laboratories & results of their analysis are awaited. It may be recalled that mulching by a variety of biomass- waste material

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गोरखी - मीठुनी - २१६२ - २११११

Progress Report of the work done on land at Ghorakhi
Tadharwadi in collaboration with NART during the
year 2006 (1st April 2006 to 31st March 2007)

Introduction

In the previous reports of work done on this land
and progress achieved, the increase in the number of
species of grasses & herbs and the regeneration and growth
of trees have already been noted. The ~~is~~ qualitative
improvement of grasses has been noted also. The ~~total~~
total biomass in the area shows a significant improvement
during 2006 as a result of adequate & widespread rainfall
(more than 400 mm during the year).

Biomass To get some quantitative idea of the biomass,
1x1 m. quadrats were laid out in the grassland and
grass growing in each square was clipped at ground
level and weighed. The results are given in the
table at the end of the report. It shows a biomass
weight of 7 to 8 tonnes per hectare in the protected
area, & 3 to 4 tonnes per hectare in
the unfenced area. The weight of the dry grass was
again 300 to 600 gms per square metre.

It may be noted here that a representative
hectare in unfenced area is almost pure grass species
while a representative hectare in the fenced area has more
tree types and is therefore more of a savanna biome
than pure grassland.

Now in days grassland has value not only in terms
of fodder but also in terms of its potential as biofuel.
The per hectare weight of grass species has importance
in this context.

Soil Quality

It can be presumed that soil quality i.e. crumb
structure and nutrient content should have improved
due to protection & cessation of uncontrolled grazing in the

area. We collected soil samples from the fenced as well as the unfenced area. Besides cumb structure, nutrient content & moisture holding capacity, we wanted to assess the soil for its microbial activity such as nitrogen fixation etc. The samples have been sent to laboratories & results of their analysis are awaited. ~~Educational activity~~. It may be recalled that mulching by a variety of biomass - waste material from agricultural fields & wool sheep & goat farms was carried out earlier, to enhance microbial activity.

Educational Activity: Ecological Society's annual grassland camp was held in the last week of November. Schools & colleges ^{from Phultham} displayed keen interest in the work being carried out here. A group of college students visited the site on 31st January 2006. A held discussions with the Executive Director about how grasslands can be managed to earn a livelihood. On 28th August over 200 students from Mudhopi College, Phultham visited our site with their teachers. They wanted to understand the work being done on the site and what kind of research projects could be undertaken there. The Executive Director explained to them the significance of the work carried out here & encouraged them to undertake research projects. The college then invited Chairman Anandji to deliver a lecture in their college. A group of youth leaders from Kapsabri village also visited the site. They were interested to improve grazing forage in the village commons (collection).

Our site therefore, is helping to make people aware of the importance of grassland & associated savannah & woodland biomes.

Biodiversity

A quick survey of existing biodiversity was carried out in the month of March 2007. Its results can be seen in tables & lists in Appendix I.

Civil Works

Repairs were carried out to the storage pond which was damaged due to heavy rains. Overflow was properly channelled also.

Endappuk Hills were laid out on both east & west sides of the watchman's to provide a platform for students to gather & during the grassland camp. These platforms were ~~also~~ covered with ^{galvanised} sheets.

CONSERVATION OF A GRASSLAND AND WETLAND COMPLEX IN THE RAINSHADOW AREAS OF WESTERN GHATS, INDIA.

Justification

India has the largest population of domestic grazing and browsing animals in the world. Many traditional communities practise pastoralism. But there are no natural grasslands in India. They have been created and maintained by traditional communities through their practices of exploitation and conservation including seasonal migrations. With economic development grasslands have shrunk due to their conversion to farming, industry, human settlement, dams, roads, railways, airports, defence needs etc. Grassland flora and fauna in India are therefore, under great pressure and some of the species are threatened with extinction.

All these factors are operating in the rainshadow areas of Western Ghats. Grassland conservation is therefore, an urgent necessity.

In the past a number of tanks and reservoirs have been built in this drought-prone area to provide irrigation and drinking water. Over the years they have been attracting large numbers of waterfowl including migratory birds. The flora and fauna of these shallow water bodies are also under great pressure due to over-exploitation, neglect of maintenance, siltation, immigration of exotic species, pollution from sewage and industrial effluents etc. These need to be properly maintained, sustainably used and their flora and fauna protected and enhanced (mainly by controlling exotics and introducing indigenous species).

Project Area

The project is to be launched in the degraded grassland areas in Satara district about 75 miles (120 kms) south-east of Pune in western Maharashtra, India. It is planned to purchase about 100 acres of land over some years. Initially it is planned to buy 15-20 acres to launch the project and later add on to it as funds permit.

The project will serve as a demonstration of sustainable management practices and as a nature reserve supplementing the official system of nature sanctuaries and national parks. It will also serve as a research and training station for our course in sustainable management of natural resources.

Aims and Objectives

1. To evolve methods of grassland restoration consistent with physical factors, climate and local needs.
2. To evolve grassland management practices consistent with local traditions and knowledge and conduct scientific research in grassland and wetland eco-systems that will prove useful for sustainable management and conservation of flora and fauna.
3. To establish a research station for the students of our training program.
4. To evolve techniques of wetland management in this drought prone region for the satisfaction of human and wildlife needs.
5. To protect and conserve grassland and wetland flora and fauna including migratory birds such as Demoiselle crane and waterfowl.
6. To find out if Sarus crane can adapt to conditions here if protection and his habitat needs are looked after.
7. To develop and manage the proposed reserve so as to enhance the public awareness of the importance of grassland and wetland conservation including their wildlife and to work with local farmers to save their crops from foraging Demoiselle cranes.

The Activity Plan

1. Purchase initially 15-20 acres of land depending on the prevailing price and availability of funds.
2. Appoint a local family to guard and look after the land.
3. Provide the family a shelter and build a warehouse to store tools and equipment and provide some work space.
4. Provide fencing: stone walls, thorns, barbed wire depending on funds availability.
5. Provide trench and mound work along the boundaries.
6. Attempt provision of well or surface irrigation.
7. Procure and/or raise in a nursery saplings of suitable species for planting.
8. Make an inventory of available flora and fauna and changes in their occurrence through seasons.
9. Attempt contour survey, identify stream flows, drainage pattern, geological and geomorphological features.
10. Identify vegetation zones, major habitats and assess their areas.
11. Make a restoration and landscape development plan.
12. Identify area suitable for the creation of a wetland.
13. Create a wetland by bunding stream flows and determining its shape and size by studying physical factors.
14. Introduce local and indigenous plant species in the wetland & attempt Sarus crane introduction.
15. Provide students with research projects that generate and monitor useful data for management and conservation; work for increasing public awareness including helping farmers ward off damage to their crops from wildlife, especially cranes.
16. Provide camping facilities for students and a rest house-cum-visitor centre for visitors and scientists.

Project Implementation

Initially it is proposed to take up an area of about 15-20 acres for grassland and wetland restoration. Suitability of the area will be determined mainly on the basis of physiography, and drainage pattern. Depending on the availability of funds the work of fencing the area would begin then. Simultaneously a worker family will be hired to guard the land and look after it. The family will be provided with a shelter and a warehouse cum work shed will be constructed. Camping facilities will be provided for students. They will be given the work of inventorying the flora and fauna. Trenches and pits will be dug around the boundary to plant local and suitable trees and bushes. Attempts will be made to get water for irrigation from the nearest source or by digging a well. A contour survey will be carried out by students under the guidance of their teachers and physical features, geology, geomorphology, stream flows and drainage patterns identified. A habitat pattern will be identified on this basis as well as the distribution and character of vegetation. For creation of a wetland a suitable site will be identified. Physical factors and the habitat pattern will help decide the size and shape of the wetland.

A landscape restoration and development plan will be prepared containing the following elements :

Plantation plan; access paths; nature trails; wetland size, shape and substrate; design of banks; water-level control structures; provision of water holes, den and dusting area for wildlife; boulder, sand and gravel placement; provision of hides; camping facilities including sanitation, design of a rest-house-cum-visitor centre.

This plan will be prepared by the students of resource management course under the guidance of experts. They will also help in implementing it as a part of their course activities. This work will be blended with research work in grassland and wetland ecology. Such work will involve:

1. Study of soil quality and changes in it with the onset of restoration efforts.
2. Raising different grass species and study their growth, water and nutrition requirements, quality as food and fodder, stress factors etc.
3. Seasonal changes in flora and fauna, fruiting and flowering of plants, pollinator agents and their activity, natural regeneration with restorative efforts, changes according to seasons in the variety and abundance of insects and other invertebrates, immigration and emigration of birds and other fauna, study of reptiles and higher fauna as they make their appearance with restoration of habitats.
4. Influence of physical factors and climate on flora and fauna.
5. Study of wetland water-level fluctuations and their effects on flora and fauna.

Attempt introduction of Sarus pairs procured from zoos etc.

Schedule of Work

First year : 2000-2001 (Hopefully)!

1. Buying land for the project *✓ already released*
2. Hiring a worker family *✓ " "*
3. Building shelter and warehouse *✓ " "*
4. Provide suitable fencing *_____ "*
5. Provision of camping facilities
6. Inventorying flora and fauna
7. Trench-cum-mound along the boundaries
8. Preparation of contour survey and restoration and development plans
9. Making contact with local farmers for advice, dissemination of information etc.

Second Year 2001-2002

1. Provision of irrigation and water supply
2. Identification of habitat pattern
3. Identifying a suitable site for wetland creation
4. Procurement of suitable saplings for plantation and carry out plantation

5. Provision of access paths and nature trails
6. Placement of boulders, sand and gravel
7. Digging of wetland and provision of bunding

Third Year 2002-2003

1. Completing the wetland according planned shape and size
2. Providing it with a source of water
3. Introduction of indigenous wetland plants
4. Provision of water holes, den and dusting areas for wildlife
5. Provision of hides
6. Introduction of Sarus crane
7. Construction of a rest house-cum-visitor centre if funds permit.

Side by side with these students will carry out research in grassland and wetland eco-systems as indicated above. In subsequent years it is proposed to increase the area of this reserve to carry out activities that remain unfinished at the end of 3 years and collect relevant data useful for sustainable management.

Budget

Item	Dollar value	Rupee value
Buying land 15-20 acres of land	6300	300,000
Fencing stones, thorns	1000	45,000
Fencing barbed wire	5000	2,25,000
Worker shelter and warehouse	2800	1,00,000
3 yr provision of worker wages @Rs.2500/- per month	2500	1,08,000
Digging trench-cum-mound	1000	45,000
Provision of pipe or well irrigation	5000	2,25,000
Provision of camping tents, sanitation	1500	70,000
Preparation of landscape development plan	300	20,000
Trail-making and landscaping	2300	1,00,000
Creation of wetland	5000	2,25,000
Planting, introduction of vegetation	1000	45,000

Introduction of Sarus crane	1000	45,000
Tools and accessories	1500	70,000
Stationery, computer, printing, media work	2000	90,000
Postage, telephones	500	13,500
Contingencies	1000	45,000
Provision of rest house-visitor center	20,000	9,00,000

59,700

\$