Resource Assessment Methods for Sustainable Collection of Devil's Claw in Namibia

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Harpagophytum procumbens

Harpagophytum zeyheri

Distribution

- Habitat: sandy soils within the Kalahari Basin in southern Africa

Approximate Distribution Area

Specific Study Areas

What is Devil’s Claw?

- Prostrate-growing geophyte,
- Resprouting in spring from a tuberous taproot (main tuber) and dying back at the end of the growing season, or when conditions become excessively dry
- Assimilates and water for surviving unfavourable seasons are stored in secondary tubers that form on lateral roots off the main tuber

Devil's Claw plant

Main (top) and secondary tubers (right)

Harvesting and Products

- The secondary tubers contain the highest concentration of active ingredients, of which especially Harpagoside is valued for its analgesic and anti-inflammatory properties
- These tubers are dug out, sliced and dried and eventually shipped to pharmaceutical companies for further processing

Harvesting

Drying the sliced tubers

Who and How Much?

- Harvesting Devil's Claw is hard work, but it is currently estimated that up to 10 000 of the poorest households in Southern Africa, mostly Namibia, derive an additional income from it
- Annual exports of dried tubers from both Devil's Claw species range between 500 and 800 t annually, but have already exceeded 1000 t (known figures from Namibia, Botswana and South Africa)

Many of the harvesters in Namibia are San, who have been using Devil's Claw tubers as a panacea for centuries. Even today *Kamagu*, as they call it, is one of their most valued medicines.

Our first studies started with San communities, as these people knew best where to find the plants and how to harvest without killing the plant

Addressing Sustainability Questions - Initial Work

- At several target communities, we determined annual harvesting quotas – based on density estimates and regeneration rates - the latter recorded from Botswana
- Plant densities were determined by counting plants along randomly-walked 2-m wide transects through areas that community members took us to

Problems:

- Not knowing typical distribution patterns, estimated area of occurrence was relatively inaccurate and thus also total amounts of plants estimated
- Community members often took us to one site and harvested somewhere else – thus monitoring efforts were flawed
- Community members told us they could harvest the same plant every second year – we could not verify this due to lack of data

Addressing Sustainability Questions - Supportive Research

Questions about Devil's Claw that needed the most urgent answers were:

- What density and distribution patterns can be expected in different habitats and vegetation types?
- Can above-ground development of the plants be related to below-ground regeneration of secondary tubers?
- How is the regeneration of secondary tubers affected by the highly variable rainfalls?
- Even if the recommended harvesting method leaves the main tuber and taproot undisturbed, what is the impact of harvesting on the population status overall?
- Are there any other factors that may cause populations to decline?

Plant Density Measurements

- Methods known to yield the most accurate results and tried in the field included distance methods (Nearest-Neighbour), angle-order methods and the Variable Area Transect Method
  - Variable Area Transect Method proved most rapid and practical
  - Was adapted slightly to take the plant distribution patterns into account, as well as prevent errors during density surveys
    - → With this method it is easy to work out an average density per 100 m² (or 100 steps²) on site to verify if this more or less reflects the observed plant-distribution

This method was used to do a country-wide assessment of Devil's Claw in Namibia, giving an indication of the different densities of the resource in different habitats in the country

- Harvesters of the target communities were trained and involved every year in the resource surveys – over a 5-year period

Population Studies

- Carried out on the land of the target communities
- Locations were close to settlements so that all community members could always see what we were doing and when
  - Diameter of the main tuber is used to indicate Age State of a plant
  - Age States were determined at the onset of the study in several populations with zero to high harvesting levels

Age States:

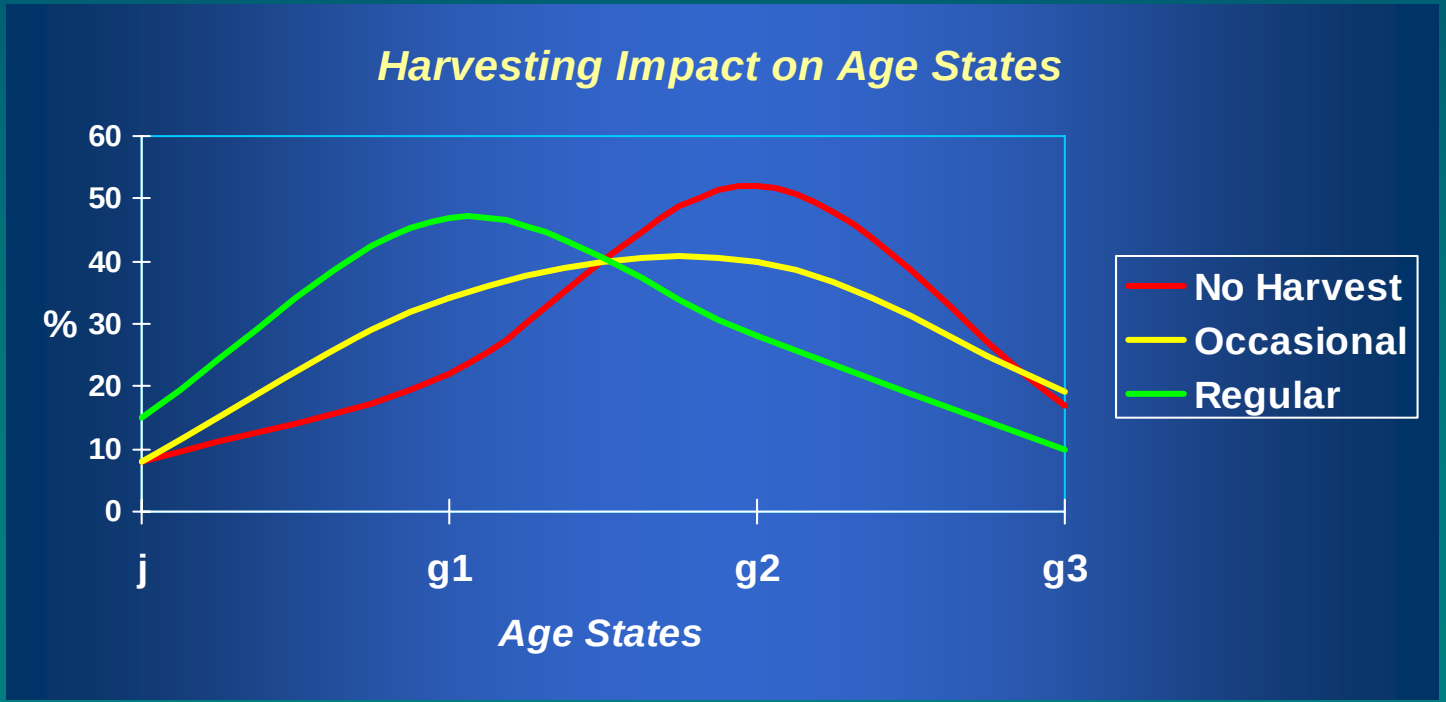
j: 0.6 -1.4

g1: 1.5 – 2.3

g2: 2.4 – 3.4

g3: > 3.5

Main tuber Ø in cm



Population Studies

- On fixed observation sites:
  - Community members recorded daily rainfall during the study
  - Harvesting was only allowed as part of the study – this was 'policed' by the communities
  - all plants were mapped and measured before and after the 5-year study period to determine population growth rates
    - → Growth rates remained stable, despite harvesting
    - → Harvesting itself did not cause increased mortality rates
    - → At one site the population decreased due to unsuitable soil conditions; showing that source- and sink populations exist!

Selected plants were harvested together with community members every second year to determine secondary tuber regeneration rates

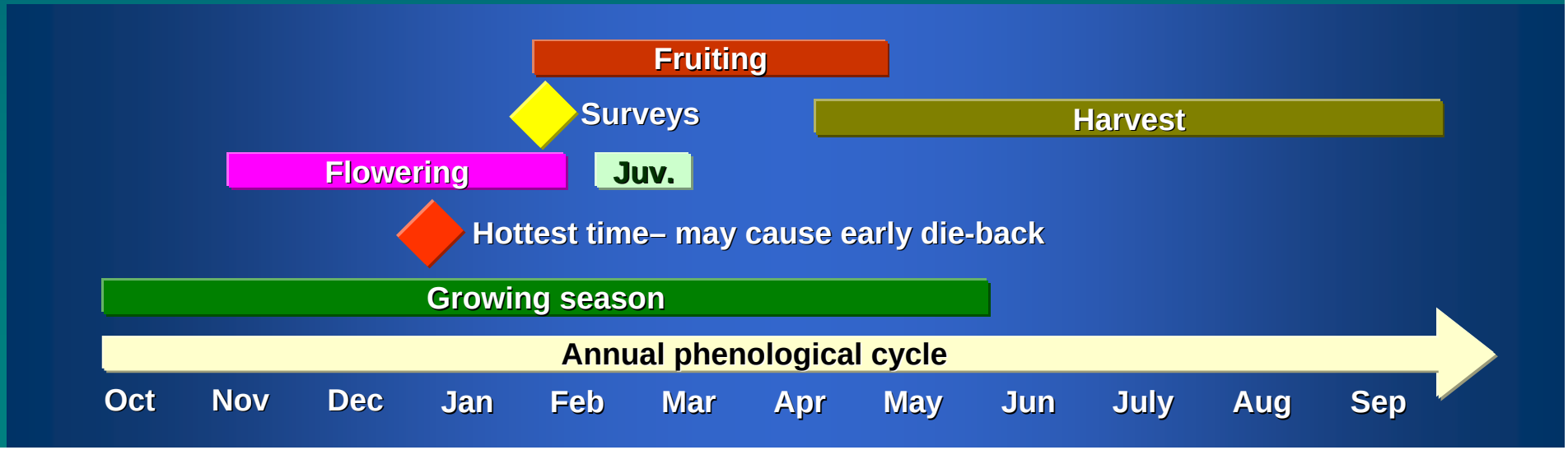
- → Results showed most importantly that plants need at least 3 years rest before the next harvest

Population Studies

- On the fixed sites:
  - Selected plants were monitored monthly over 3 years to determine phenological patterns
    - → Seedlings usually only emerge late February
    - → Above-ground plant spread depends on competition from surrounding vegetation – plants of all age states can reach the same canopy spread
    - → Plants on fenced sites - protected from heavy grazing – had a far lower mortality and far higher tuber growth- and regeneration rate
    - → Plants die back early or remain dormant if rains are poor
  - Results were used to optimise the timing of the resource surveys and served as guideline for the legally allowed harvesting season (March to October)

Survey Methods Timing and Management

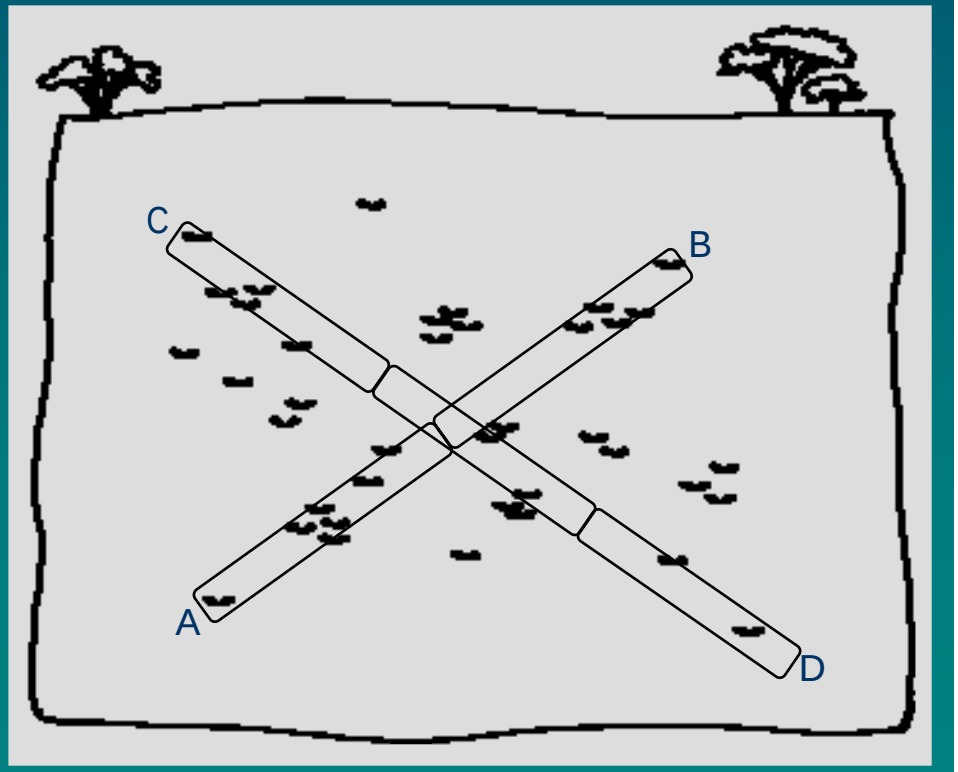
- Surveys are conducted late January to early February – this ensures that only healthy growing plants are included, whilst also giving enough time to obtain the necessary permits prior to harvesting
- Communities should identify all resource patches on their rangelands, determine who should harvest where and divide the resource into a 4-year rotational cycle



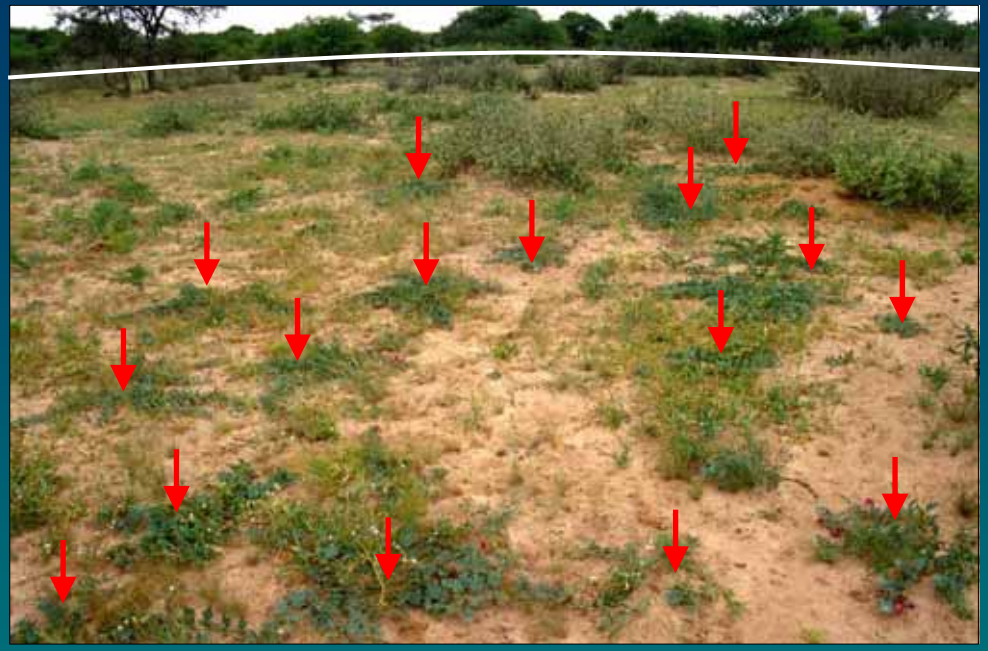
Survey Methods - Large Localised Patches

- Large patches of Devil's Claw occur where other vegetation is sparse or degraded, e.g. around homesteads or on old fields
- Often several 100 m in diameter, high densities, patches stop relatively abrupt where vegetation or soil changes

- Count all Devil's Claw plants per 100 steps
- Start counting where the first plants are found, and continue in 100-step segments until no more plants are seen
- Repeat at least once in a perpendicular direction, do more walks if possible



Typical Habitats



Left: overgrazed area where typically dense large patches of Devil's Claw will establish

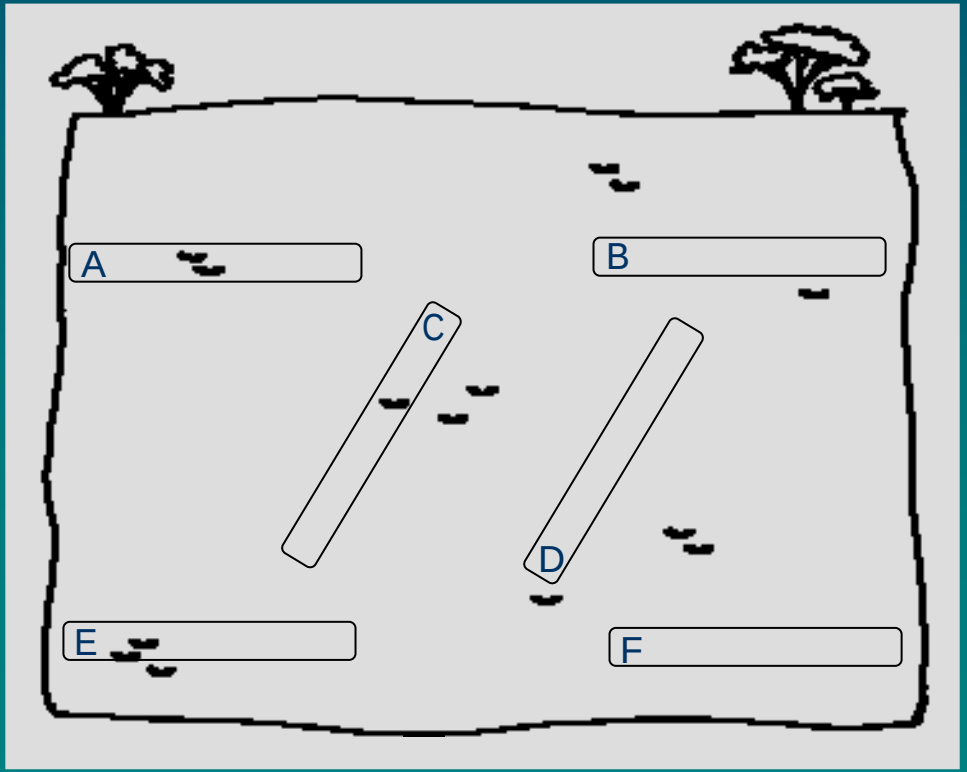
Right: relatively healthy rangeland where typically small groups of Devil's Claw plants will be found, but spread out over larger area

Devil's Claw is a weak competitor, but will increase over time if competition from surrounding vegetation decreases

Survey Methods - Small Wide-Spread Patches

- Small groups of Devil's Claw occur in more dense yet open savannas, maybe with small bare areas in-between
- Spread over several km's, where soil is suitable, usually less than 10 plants together

- Count all Devil's Claw plants per 100 steps
- Walk 100 step segments spread randomly over about 1km² or a specific camp on farmland
- A minimum of 15 segments is recommended, more encouraged



Survey Methods
Some Practical Points

- The transect width is fixed at 2 m but…
  - As plant diameter may vary from 30 cm to 350 cm depending on rainfall, only plants *rooted* within a width corresponding to the stretched-out arms of a person may be counted
- Surveys work best when one person walks ahead, strictly keeping the direction and counting off 100 steps at a time, a second person walks behind and concentrates only on counting the plants
- Obstructions (shrubs, trees) are sidestepped and the segment carried on in the same direction

Taking Local Experience to Zimbabwe

What was different:

- Initial surveys conducted by a Namibian community worker, had been involved in local surveys but has no ecological training – he was assisted by local community members not familiar with the surveying rules
- Zimbabwean communities only know the plant as one of several undesirable weeds
- Average rainfall is much higher, so plants usually grow much bigger, but not as close together as at the Namibian sites
- Difficult financial circumstances in Zimbabwe cause communities and development workers to be over-keen to turn anything into money as quickly as possible

Taking Local Experience to Zimbabwe

What went wrong:

- We did not know the general habitat and vegetation when receiving the first survey counts, thus could not judge the recorded high densities – only during a later visit we realised that the 2 m width rule had often been ignored
- Development workers did not know the distribution patterns of the plants and over-estimated the possible total quota

Dense vegetation with crop fields in-between (top) – *Devil's Claw* only establishes in the fields (right)

Insights and Conclusions

- During the 5 years harvesters from the Namibian communities learnt that the quota assessments were fair – even if quotas were low after poor rainfall seasons
- By actually being involved in counting plants themselves, they had a much better idea of their total resource
- During a very dry year during the project harvesters themselves decided not to harvest that year – realising themselves that plants need a longer rest period than they had originally bargained on
  - This trust was clearly lacking and could not be established during a 4-day training visit to Zimbabwe
- The research showed that harvesting impact itself – provided correct harvesting methods are adhered to - was not the biggest threat to Devil's Claw – bush encroachment and constant grazing due to overall lack of poor rangeland management can be a far bigger threat!

Insights and Conclusions

- To ensure the sustainable harvest of a plant like Devil's Claw requires good knowledge of its ecological requirements, its life cycle and relatively accurate resource assessment methods… but

This single species-focus alone does not guarantee long-term survival of the species

- The health of the environment or ecosystem of which Devil's Claw is part of must also be monitored
- Socio-economic issues often contributing to the degradation of the environment must be understood before plans can be worked out to improve the situation

Further Recommendations

- Always investigate the possibilities of cultivation to augment natural populations – it instills an understanding that natural resources are not unlimited and ownership leads to more conscious resource management!

6-month old seedlings ready for transplanting onto fields

Our Follow-Up Work

- At one target community it was decided that a piece of land with Devil's Claw can be fenced off to be exclusively managed by a small group of harvesters
  - These harvesters have to clear all invasive shrubs
    - → Wood is sold as firewood or used in the community for cooking
  - The harvesters also have to prevent livestock entering the fenced area during the growing season
    - → Grazing that does recover is used only as winter-fodder, once all Devil's Claw plants have died back
- It is hoped that we will convince other community members after about 2 years that time and effort spent on debushing and improved grazing management benefits more than just the environment!

Acknowledgements

Research was made possible by:

BfN 100 Jahre Naturschutz als Staatsaufgabe
Zukunft mit Natur
Bundesamt für Naturschutz

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