

Report to the

**EC Clima East Pilot Project “Ecosystem
based approaches to climate change”**

within the frame of a

**Complex inventory of pastureland in a selected pilot area
of Ismayilli region of Azerbaijan, including further detail
planning:**

Component Deliverable 3 Pasture restoration activities

Partly based on a field stay between May 21st and May 25th

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1 Description of Deliverable 3 Pasture restoration activities, as from DUENE offer

Restoration activities should already be started in 2014. However, full knowledge on the extent of areas that need to be restored will be a result of the pasture inventory process and the full catalogue of measures to be applied will be a part of the derived management recommendations. Nonetheless, two activities for a successful implementation of restoration measures are necessarily to be started in 2014.

Bio-engineering encompasses methods to halt erosion by means of natural materials, preferably living and dead plant material (Begemann & Schiechtel 1994, Hacker & Johannsen 2011, Pflug 1988, Schiechtel 1973¹).

A project of DUENE e.V. and GABA in 2013 in a mountain village in the Greater Caucasus gathered experiences in this field (see http://www.duene-greifswald.de/de/projekte.php_deicsa.php). These experiences can be used during the run of our project here.

For producing significant amounts of autochthonic woody planting material (shrub and tree species growing in the project region) the establishment of a tree nursery is advised, preferably in the close village Burovdal, where permanent caring would be feasible.

Therefore, a tree nursery plot has to be fenced, provided with water supply, and a drip irrigation system has to be installed. Planting of cuttings (living branch tips of native bush and tree species) can already start in June/July. Seeding of seeds from available species can start in late summer to autumn. With these measures and good care, already in 2015, small bushes and trees could be planted at erosion/degradation hotspots. With good care, even already in autumn 2014 plantable bushes or trees of some species might be available for planting.

This planting material can be as well used for planting hedgerows, preferably of thorny species, as in other bio-engineering measures like so called brush layering.

Plantations need to be protected by fences in the first years. Later, if densely grown and especially if thorny, fences can be removed again and used at other erosion sites. Therefore, already in 2014 some pilot erosion/degradation hotspots might be identified, visually and by means of remote sensing, and fenced in. For wider implementation in 2015 it will be useful to observe, whether snow load/avalanches as well as theft are significant threats for this measure.

In general, fencing would also allow for natural regeneration of a closed vegetation cover on severely degraded sites.

Time schedule:

Methodology for restoration

- until end of May 2014

Establishment of tree nursery

- until mid of June 2014

First planting and fencing activities

¹ Begemann, W. & Schiechtel, H.M. (1994): Ingenieurbiologie. Handbuch zum ökologischen Wasser und Erdbau. 2nd Edition. Bauverlag, Wiesbaden: 203pp.

Hacker, E. & Johannsen, R. (2011): Ingenieurbiologie. Lehrbuch. 1st Edition. Ulmer UTB- Verlag, Ulm: 383pp.

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- until end of October 2014
- Planning of further planting, fencing and other restoration activities
- end of November 2014

2 Itinerary of field days in May 2014

2.1 20.05. – 22.05.2014: Travel Baku – Qax – SARIBASH – Ilisu – Baku

Aim:

- In a joint delegation of ECO-GIZ-IEC-project (P. Sass (PS), E. Namazov (EN), Serdar Hajiyev (SH)), UNDP-EU-Climate East (Silvija Kalnins, Eltekin Omarov (EO) and Huseyn...) visit of the ICI Project DEICSA (“Decreasing erosion by improving carbon stocks in the strongly degraded surrounding of the high-mountain village Saribash in the Greater Caucasus of Azerbaijan”) in the village of Saribash, presented by the implementing partners GABA (amongst others Vugar Babayev) and DUENE e.V. (Jonathan Etzold (JE)). Evaluation of measures from 2013, including established tree nursery (lessons learnt see below at 3.2), fenced plantations on erosion hotspots and bio-engineering measures.

2.2 24.05. - 25.05.2014: Travel Baku – Lahich – BUROVDAL – Lahich – Ismayilli (EN, EO, JE)

Aim:

- Visit of target area of the project UNDP-EU-Climate East around Burovdal village. Discussion of steps for tree nursery establishment on already prepared plot, identification of woody species to be propagated here.
- Discussion of ways of joining forces between both projects, e.g. in exchange of knowledge, technologies and training of local population for these methodologies.
-

3 Project interventions to decrease erosion

3.1 General approach

A high vegetation cover hinders erosion. Therefore, any measures to increase this cover are helping to diminish erosion.

How?

- Grazing exclusion from parts that are particularly susceptible to or already heavily affected by erosion.
- By fencing which allows for undisturbed recovery of vegetation cover.
- By planting bushes and trees at “hotspots” of erosion. For their successful establishment fences protecting the plantations are necessary.
- By sowing autochthonous seeds e.g. from hay residues on eroded sites, best inside of fences.
- By other bio-engineering measures on eroded sites.
- By creating alternative income sources to reduce dependence of local population on animal husbandry and by this finally decrease animal numbers and grazing pressure.
- By better management of grazing regimes, adapted to site conditions driving susceptibility to erosion.

3.2 Tree nursery site in Burovdal village

For producing sufficient numbers of autochthonous and therefore regionally adapted trees and bushes a tree nursery has to be established.

Necessary steps are based on the experience and many very valuable lessons learnt of the establishment of a pilot tree nursery in 2013 in the village Saribash in Qax District.

Among these lessons learnt are:

- a) Ploughing/ digging of the tree nursery plot as soon as possible, to allow for better cleaning of plant parts and roots of the current meadow prior to planting of tree and bush cuttings. This eases later efforts for weed control. This has to be done regularly.
- b) Thorough protection of the plot from intruding livestock by fencing
- c) Installation of professional shading systems from commercial glass house gardening to protect sensitive tree and bush cuttings from too high sun radiation.
- d) To create with drip irrigation permanently moist, however not wet conditions.
- e) Arrange rows in a way that enough place remains for planting and cleaning without destroying other rows. A pattern could be two narrow rows, a wider gap and then again two narrow rows etc.
- f) For seeding of especially large seeds/nuts to use containers of a depth of at least 10 cm. For seeds grown in open soil to replant them to single pots as soon you can handle them. All pots should get casted into soil surface for better frost protection and maybe also irrigation.
- g) Methods for frost protection are necessary, as well for tree nursery and trees/bushes planted to their permanent positions. Recommended is thick mulching with old hay/other plant residues. These would also help for the following year to reduce efforts of weed control.

Criteria for selecting a tree nursery plot were discussed in email and skype conversation between EO and JE.

According to these criteria a plot for the nursery was identified in mid of April 2014 next to the main access road to Burovdal village by EO and villagers. The site, a former garden, is close to the village, therefore allows for permanent care. It is close to a water source and now fully protected by a brush fence and bushes. The size is approx. 23 x 14 m.

The villager Badal was selected to prepare the tree nursery plot.

On the field visit on 24.05.2014 the plot was found to be completely cleaned from the grass cover. The soil is sandy-gravelly-humic which is promising for sowing seeds and planting tree and bush cuttings.

With continued cleaning of plant parts and roots until first plantings in the beginning of July problems of weed control are regarded to be feasible. For later cleaning of weeds, additionally to the tree nursery keeper, one or two women could be contracted.

Technical specifications for the installation of a drip irrigation system were discussed beforehand via email and skype conversation between EO and JE and now approved by EN who is experienced with this issue e.g. from Saribash in 2013. The preconditions for irrigation with a slight sloping of the plot are perfect.

The same applies to the installation of a professional shading system from commercial glass house gardening. To allow for experiments, this shading should only be installed over a part of the nursery. It will be interesting to learn whether all species to be propagated here in future are in need of this sophisticated protection.

Both installations have to be functioning before planting starts.

In the beginning of July cuttings of at least 13 tree and bush species (see Table 1, column “Propagation from cuttings in early summer”) could be planted in the tree nursery. The cuttings (i.e. 20-30 cm branch tips of bush and tree species, for summer planting soft fresh wood) should be collected in the nearer surrounding of the village from as many plant individuals as possible (to gain genetic diversity) and brought carefully and immediately to the moist soil of the nursery. Personnel and interested villagers will need to be trained in these techniques.

The preliminary list of the in total 26 species (Table 1) was developed on observations of the nearer surroundings of Burovdal during the field visit on 24. and 25.05.2014. Of importance will be their suitability for different site conditions, traits like thorns and non-palatibility for effective planting as living fences and also the potential other benefits for villagers (fruit collection, bee pasture, fire wood etc.). Guidelines for propagation worked out for the Saribash tree nursery will be adapted to the Burovdal situation. A short version is given here. Some of the species are said to be planted best in autumn only (see Table 1, column “Propagation from cuttings in autumn”). However, for testing reasons, they should be collected now as well.

For other bush and tree species seeding is the most perspective way of propagation (see Table 1, column “Propagation from seeds”). This will take place during autumn after the particular seeds could be collected.

For testing purposes experiments with planting/seeding into open soil and/or containers/pots will take place. The latter shall have a depth of at least 10 cm.

During the field visit on 24. and 25.05.2014, we found seedlings of *Quercus*, *Carpinus* and other species on the margins of the the river bed, where they obviously had found good conditions for germination. The next bigger flood would destroy them. In the beginning of July they should become carefully transplanted to deep containers and kept in the tree nursery. They might be planted out already in autumn 2014.

All plant material planted in the tree nursery should be properly provided with water and with shadow if necessary. Cleaning of weeds is necessary to reduce root concurrence. Covering with mulch might ease this work. In autumn mulching is recommended as frost protection (see above).

Table 1: Preliminary list of woody species occurring in the surrounding of Burovdal village. Short information on names, propagation methods and time (long list in preparation).

Nr.	Family	Botanical name	English name	Azeri name	thorny/ spikey?	Poisonous?	Propag ation from seeds	Propag ation from cuttings in early summer	Propag ation from cuttings in autumn	Direct use of cutting s without rooting in nursery for bio- enginee ring
1	Adoxaceae	<i>Viburnum lantana</i>	Wayfaring tree	Lantana başınağacı	n	y (Large quantities of the fruit can cause vomiting and diarrhoea [PFAF]).	1	1	1	
2	Berberidaceae	<i>Berberis spp.</i>	Berberis	Zirinc	y	n	1		1	
3	Betulaceae	<i>Betula pendula/litwinowii</i> [further descriptions refer to <i>B. pendula</i> only but might be applicable to other <i>Betula</i> spp. as well]	Silver birch/Caucasian Down Birch	Sallaq tozağacı/...to zağacı	n	n	1 (seed ripening August-September)	not mentioned	not mentioned	not mentioned
4	Betulaceae	<i>Carpinus betulus</i> (syn. <i>C. caucasica</i>)	Hornbeam, European hornbeam	Qafqaz vələsi	n	n	1	not mentioned	not mentioned	not mentioned
5	Betulaceae	<i>Corylus maxima</i> (<i>C. avellana</i> var. <i>purpurea</i> , <i>C. Avellana</i> var. <i>rubra</i>)	Filbert (<i>C. maxima</i>); Hazelnut (<i>C. Avellana</i>)	Adi findıq	n	n				
6	Caprifoliaceae	<i>Lonicera xylosteum</i> (foll. FIAZ VIII p. 62 also <i>L. caucasica</i> and <i>L. iberica</i>)	Fly honeysuckle	Adi doquzdun	n	y (berries weakly poisonous)	1	1		
7	Cornaceae	<i>Cornus mas</i>	Cornel cherry, Cornelian cherry	Zoğal	n	n	1	1	1	

8	Cornaceae	<i>Cornus sanguinea</i> (s.l.) In FIAZ VI S. 510 given as <i>Thelycrania australis</i>	Common dogwood	Garamurdarc ha Genus: zoğal	n	y (Might be problematic for sensitive people: fruits raw rather unpalatable (risk of gastroenteritis), leaves can cause skin irritations through their calcium carbonate incrusted trichomes [PFAF])	1	1	1	
9	Elaeagnaceae	<i>Hippophae rhamnoides</i>	Buckthorn	Çaytikanı	y	n	1	1	1	
10	Fagaceae	<i>Quercus macranthera</i> , maybe partly still <i>Qu. Iberica</i> in this altitude	Caucasian Oak	?	n	n	1			
11	Juglandaceae	<i>Juglans regia</i>	Walnut	Qoz	n	n	1			
12	Rosaceae	<i>Crataegus</i> spp. [e.g. <i>C. pentagyna</i> , <i>C. microphylla</i> , <i>C. pontica</i> , <i>C. szovitsii</i> , <i>C. tournefortii</i> , <i>C. ulotricha</i> , <i>C. zangezura</i> ; according to FIAZ: <i>C. orientalis</i> , <i>C. meyeri</i> , <i>C. caucasica</i> , <i>C. lagenaria</i> , <i>C. kyrtostyla</i> und <i>C. pentagyna</i> .]	Hawthorn	Yemişan	y	n	1			
13	Rosaceae	<i>Malus orientalis</i> & <i>M. domestica</i> (?)	Wild & domestic apple and other species of the village's fruit orchard	Alma	n	n	1		1	
14	Rosaceae	<i>Mespilus germanica</i>	Common Medlar	Alman əzgili, adi əzgil, qafqaz əzgili	y, young shoots	n	1		1	
15	Rosaceae	<i>Prunus avium</i> (<i>Cerasus avium</i>)	Wild cherry	Gilas	n	n	1	1		

16	Rosaceae	<i>Prunus cerasifera</i> (<i>P. divaricata</i> , <i>P. cerasifera</i> ssp. <i>divaricata</i>)	Cherry plum, myrobalan plum	Alça	n	n	1	1		
17	Rosaceae	<i>Pyrus domestica</i> subsp. <i>caucasica</i> (<i>P. caucasica</i>)	Pear	Armud	n	n	1	1		
18	Rosaceae	<i>Rosa</i> spp. [e.g. <i>R. doluchanovii</i> , <i>R. foetida</i> , <i>R. gallica</i> , <i>R. jundzillii</i> , <i>R. majalis</i> , <i>R. spinosissima</i> , <i>R. villosa</i> , <i>R. pulverulenta</i>]	different wild rose species, e.g. Dog rose	Itburnu (Həmərsin)	y	n	1	1	1	
19	Rosaceae	<i>Sorbus caucasica</i>		Qafqaz quşarmudu	n	n	1	1		
20	Salicaceae	<i>Populus alba</i>	White poplar	Ağcaqovaq	n	n	1	?	1	?
21	Salicaceae	<i>Populus tremula</i>	Aspen poplar	Əsməqovaq, titrək qovaq	n	n	1	?	1	?
22	Salicaceae	<i>Salix broad-leaved</i> (different species, <i>Salix cf. caprea</i>)	willow	Söyüd	n	n	1	(1)	(1)	?
23	Salicaceae	<i>Salix narrow-leaved</i> (different species)	Willows	Söyüd	n	n	1		1	1
24	Sapindaceae	<i>Acer campestre</i>	Field maple, Hedge maple	çöl ağcaqayını	n	n	1	1	?	
25	Tamaricaceae	<i>Myricaria germanica</i>	German tamarisk	Tülküquyruq çayyovşanı	n	n	1	1	1	
26	Ulmaceae	<i>Ulmus</i> sp. - under http://www.botany.az/upload/s/haciyev_vahid/pdf_ler/Botanika_nstitutunu_srlri-2012.pdf mentioned <i>U. minor</i> , <i>U. glabra</i> , <i>U. scabra</i> (= <i>Syn. to glabra?!</i>) for AZ.	Elm	Qarağac	n	n	1 (seed ripening May-June)			

3.3 Restoration of the 16 pilote summer pastures

Improved pasture management, an outcome of the Pasture Inventory with support of Remote Sensing, is the basic principle for pasture restoration.

However, direct interventions on erosion/degradation hotspots might become necessary. Such severely degraded sites of all 16 summer pastures will become obvious after the Pasture Inventory and a supervised classification have been conducted. .

On the most severely degraded sites, fencing would become necessary to allow for undisturbed natural regeneration of a closed vegetation cover. In case of strong soil dislocation bio-engineering measures using rooted and unrooted woody material can be used.

Already until July 2014 some pilot erosion/degradation hotspots might be identified, visually and by means of remote sensing, to test the above mentioned methods.

Suitable plots which also do not interfere with the absolutely necessary cooperation of the 16 livestock farms and which are even more regarded as advantageous for their own purposes should be chosen. These could be eroding slopes along necessary access roads to the camps.

Here, already in summer 2014 fences should be build up. This will stop disturbance of grazing and trampling livestock and might allow already for recovery of the vegetation cover, including the remaining strongly browsed bushes.

Building fences already in 2014 can also serve for testing the durability of these measures. Site dependent, snow load or avalanches might destroy fences over winter. Raising awareness in the study region for these measures should, by a certain social control within the land users' community, prevent destruction or theft of the fences.

The pasture recovery could be supported by seeding already in late summer/early autumn 2014 herbs' and grass' seeds on bare soil sites. They can be collected by using hay residues from hay storage places in the village.

With good care, already in autumn 2014 the tree nursery might have a certain output of plantable bushes or trees of some species. However, main output is expected for the following years. Those small bushes and trees available in autumn 2014 could be planted within the fenced areas to ensure their undisturbed growth in the first years.

This planting material can be planted in rows mostly parallel to the slope creating in the future a living fence or hedgerows, preferably of thorny or other not palatable species. Hence, after some years the fence can be deinstalled and build up again at other erosion hotspots.

Depending on the site conditions, different ways of planting in rows parallel to slopes will be tested, including bio-engineering methods. This includes the so called "brush layering" using living branches of narrow-leaved willows (*Salix* spp.) or combined with already rooted planting material from the tree nursery "bush brush layering" following Schiechtl 1973². Slightly inclined rows of woody species with a a water demand can also help draining moist slopes which are threatened by land slides. Other bio-engineering measures can help to diminish gully erosion, e.g. by using living branches of narrow-leaved willows (*Salix* spp.) in e.g. "gully brush filling". These and other measures are described in more detail in Annex 4.1.

² Schiechtl H. M. (1973): Sicherungsarbeiten im Landschaftsbau. Grundlagen - lebende Baustoffe - Methoden. 244 pp., Callwey -Verlag. München

4 Annex

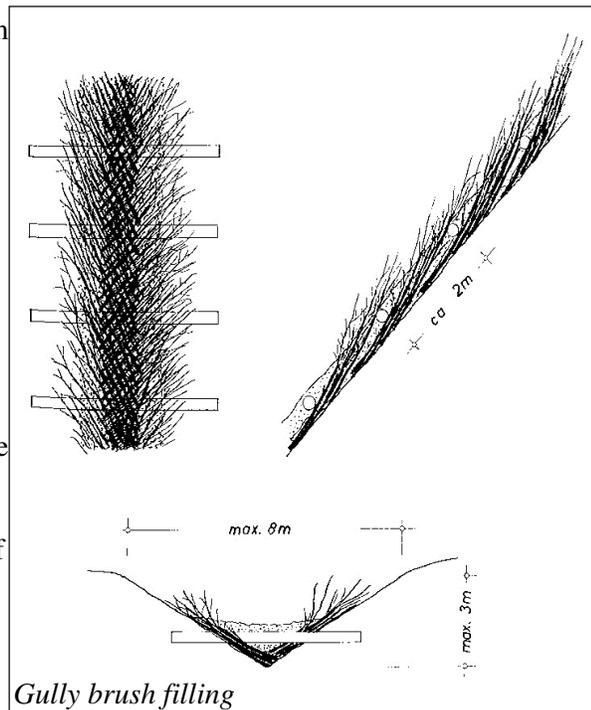
4.1 Bio-engineering methods

Cutting

- Most species root while rest in winter and therefore should not be cut too early
- Shrubs are cut directly above soil, trees are pollarded using saws or loppers, not axes
- Tree-forming willows can only be propagated vegetatively by basal cuttings, cuttings of shrub-forming willows can be taken of any plant part. Make sure to use only narrow-leaved species, as round-leaved ones do not propagate vegetatively.
- Transport cuttings in whole length, shorten at building site.
- Cuttings of pear, apple and similar poorly rooting species should be taken rather from near the trunk than from the tree tops; buckthorn cuttings are rooting regardless of their origin.

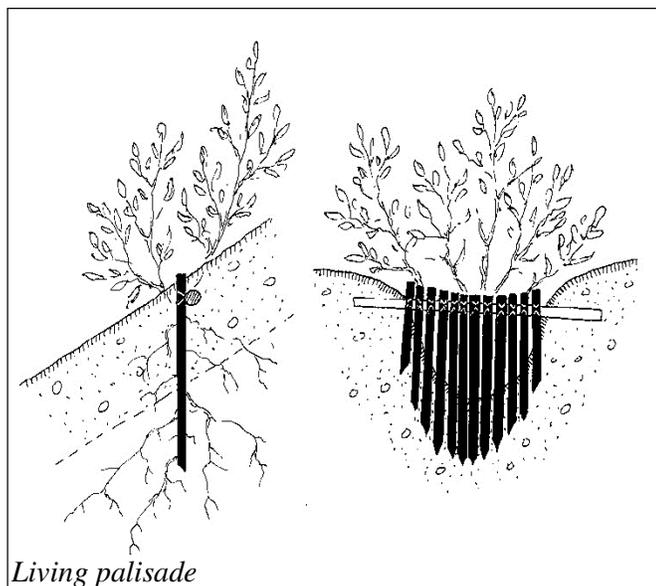
Gully brush filling (for gullies up to 3 m deep and 8 m wide)

- type 1: plug stakes in slope line into ground of the gully, fill it up to the surface with firmly packed branched and foliate cuttings (coniferous branches also suitable). Cut surfaces should be buried in soil for some decimetres to root.
- type 2: long branches are stacked in a fishbone pattern into the gully and secured by crossbars (Ø 10-16 cm, distance 1-2 m) punched into the side walls (*see picture*). Cut surfaces should be buried in soil for some decimetres to root. Max. thickness of branch layer: 0.5 m.



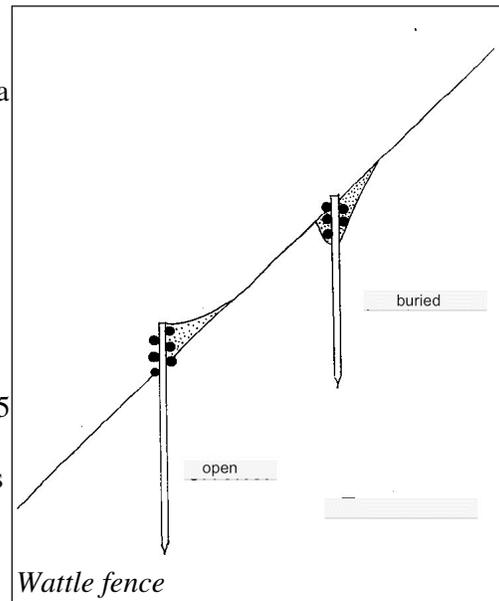
Living palisade (gullies up to 6 m width and 2-4 m depth)

- Cut straight, living, little branched terminal shoots from tree-forming willows or poplar (1,5-2,5 m long, any diameter > 5 cm) straight at the top and sharpen them at the lower end.
- Punch them in for about 1/3 of their length side by side to form a line across the gully (5-20 poles per lineal metre).
- Poles are connected to crossbars (build in gully side walls) with twine or willow stakes.



Wattle fence

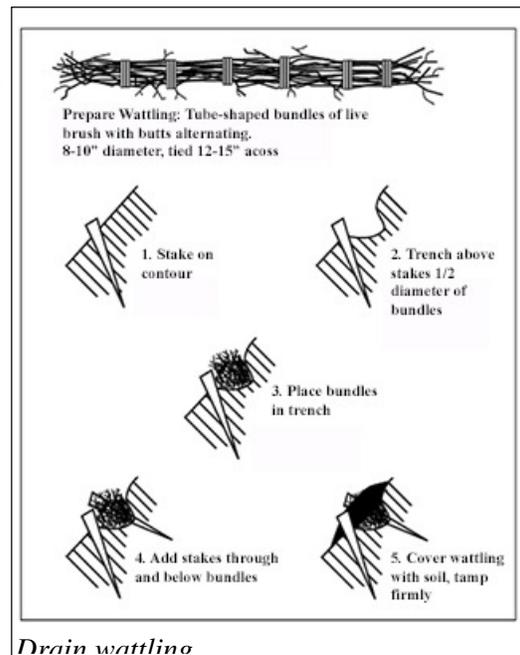
- pickets (Ø 3-10 cm, 100 cm long, to 2/3 in ground) are placed in a horizontal line with a distance of 100 cm, inbetween shorter live stakes in a distance of ca. 30 cm
- stakes and pickets are braided with flexible strong branches of willow (unbranched or nearly so, at least 1,20 m long, one to three years old; 3-7 stacked and pressed down firmly)
- pickets should overtop fence not more than 5 cm
- to root successfully, the lowermost branches and at least the cut surface of every branch must be embedded in the soil; the deeper buried the fence the better



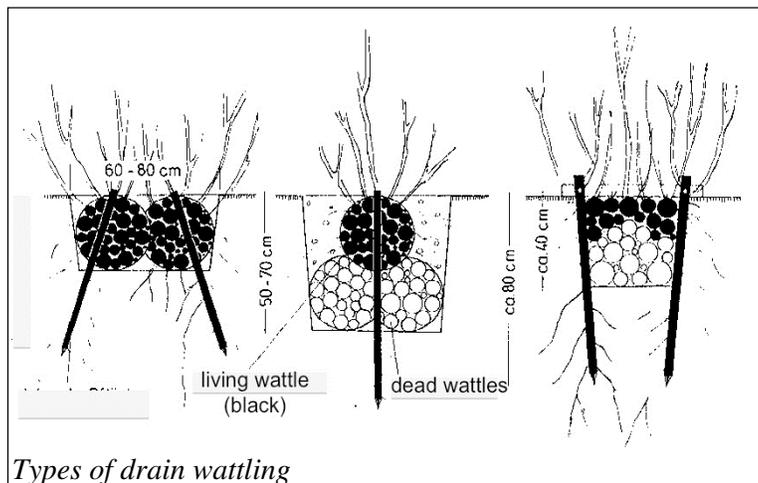
Wattle fence

Drain wattling

- Wattle/fascine: tube-shaped bundle of live brush (willow cuttings Ø 2-4 cm), each 4-6 m long and Ø 20-40 cm in diameter, tied with twine-
- Place wattles in trench so that their surface draws level with the surrounding soil surface, ends overlapping. If necessary because of trench depth, wattles can be stacked (see picture below). Only upper wattles will root.
- Punch one live stake of 30-60 cm length and Ø 3-5 cm or steel bar Ø 10-20 mm per lineal metre through wattle.
- Cover lightly with soil.
- For steep slopes, additional twines tied around the wattles can serve to fix the construction when connected to massive stakes to the left and right of the trench.



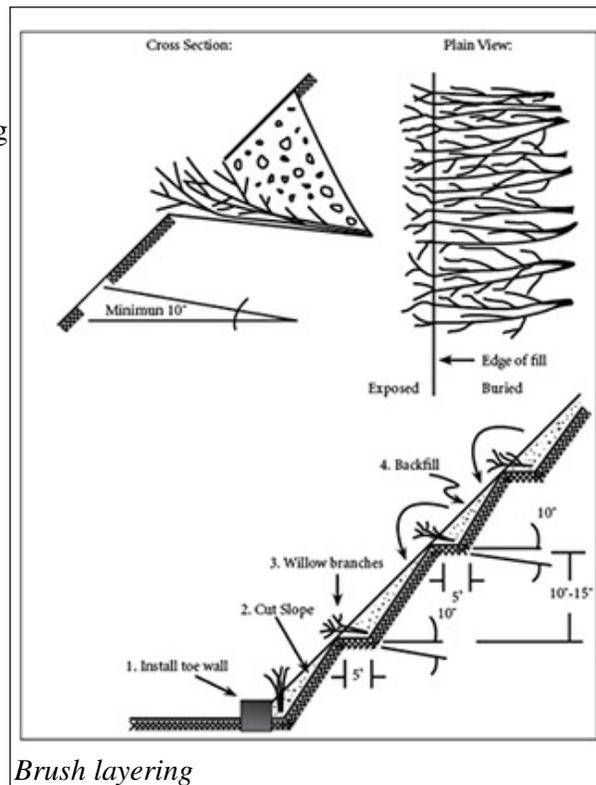
Drain wattling



Types of drain wattling

Brush layering (best depth effect)

- Construction direction: bottom-up
- Cut 0.5-0.7 m wide triangular trenches with a 10° slope (depending on site conditions horizontally to vertically; the wetter, the steeper), with a 1.5-3 m distance of rows.
- Insert 10-20 willow stakes (2 cm Ø, 1,5 m deep) per lineal metre crosswise (1-2 bare-root shrubs can be added if at hand).
- With the excavated material of the next overlying trench cover the stakes. They should stick out for only ¼ – ½ of their length. Tamp firmly.



Staking

- Place 5-10 unbranched willow cuttings per m² (Ø 1-5 cm, 25-40(-60) cm long) for ¾ of their length in scattered holes prepared with a steel bar in a 45° angle.
- Tamp firmly.

Cover

- Mulching with hay flowers: 0.5-2 kg/m² hay flowers (late summer swath or hayloft remains), watered to reduce wind dispersal. Improves soil and micro-climate by forming a vegetation cover in the next growing season (but make sure that they do not outcompete the aspired bushes).
- Surface layering: live cuttings are densely layed out between other protective constructions, thick end covered with soil and secured against wind etc. by cross-bars, wettle fences or riprap.

Plantation of rooted plants

- Autumn best season for planting
- Distance between individual plants 0,8-1,5 m
- When planted in groups of individuals of one species they will grow especially dense

References:

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