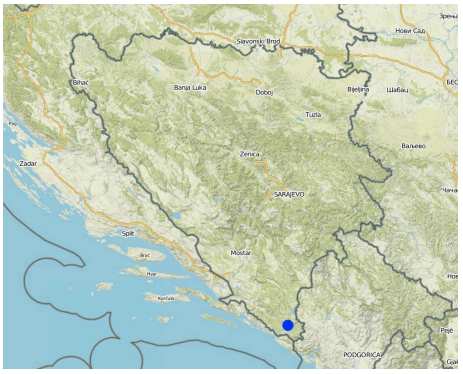
Afforestation of bare land in karst areas. (Ilić, B.)

Afforestation of bare land in karst areas ( )

Pošumljavanje goleti

Afforestation of bare land in Herzegovina region, a vulnerable area characterized by Karst landscapes, is an SLM technique aimed to increase water-holding capacity and reduce land degradation

The afforestation of bare land is a very important SLM technique, which is mainly applied in the southern part of the Republika Srpska (Bosnia and Herzegovina), but also in other parts of the country where bare land is widespread. The southern part of the country,Herzegovina, is ecologically very vulnerable and characterized by the dominance of limestone-dolomite rocks, with shallow and poorly developed soils, water deficiency over vegetation period and poor water regime, which is an additional aggravating factor for successful afforestation. Under such conditions, afforestation is the most widely used SLM measure in the area, which is characterized by karst landscapes. Namely, since 1950, there was a combination of vegetation and technical measures that would increase the chances of success when reforesting Herzegovina's bare land.
Bare land is a result of the natural features of the given region, but very often is exacerbated by unsustainable forest management, and frequent fires that have an impact on vegetation cover. This creates preconditions for soil erosion and contamination of drinking water springs. Afforestation of bare land is applied throughout the territory of Herzegovina, but mainly on forestland and public owned areas. The specificity of the natural conditions of the Herzegovinian karst, greatly reduces the range of plant species that could be considered suitable for afforestation. Also, limestone-dolomite soils are usually shallow, dry and xero-termophilic and require irrigation to increase success. However, irrigation is still not being applied on forestland, therefore forest managers use other possible measures that could reduce the water deficit in the first years of plant life, including afforestation
The Karst Management Center (under the jurisdiction of the Public Forest Enterprize “Šume Republike Srpske” and Ministry of Agriculture, Forestry and Water Management), is located in Trebinje, and manages the forests and forest land of six municipalities in Herzegovina . Every year, as part of the regular forest/karst management measures, bare land is afforested, using plant species produced in forest nurseries of the Republika Srpska. The most used ones are Pinus nigra, Pinus halepensis and Cupressus sempervirens. The newly established forest nursery in Trebinje, is consisted of ecologically adapted species to Mediterranean conditions, which constitutes a step forward to increase success of afforestation. Plants are produced in containers whose root system is coated with high quality substrate and protected by plastic foil.
The basic characteristic of the SLM measure “afforestation on bare land” is the deeper holes that need to be dug in comparison to a “regular” afforestation. The dimensions of the holes are 50x50x50cm. Due to the unfavourable conditions (high level of rockiness, shallow soils, steep slopes, water deficit etc.), it is possible to plant maximum up to 1400 plants per hectare. A low-height stonewall is being built around the hole of the tree at the lower part of the mountain, so it can retain the water from the upper parts, reduce degradation and retain soil moisture.This is particularly important for steeper slopes where it is essential to conserve soil and water for improved growth of trees and other vegetation. After putting the seedlings into the holes, soil is being put around the root system, and polyvinyl foil is being placed in funnel form, to collect rainwater and create a compact compound of the substrate in the touching zone with the soil around the root.
The best period for afforestation in Herzegovina is October and November. The technology requires manual work due to level of rockiness and steep slopes, which does not allow any use of machines. Planting seedlings is favorable during autumn due to soil compression after the rainfall of September when the contact between the holes and the substratum is fully established. This is especially important for plant resistance against drought, which lead to physiological weakness. Planting seedlings at the beginning of March is favorable only in cases when no drought occurs immediately after planting. This is possible only in the more continental part of the Karst area. When planting a tree, it is important to bear in mind that wind erosion can occur. Therefore, the substrate should be placed below the surface of the soil in the holes, especially if the planting is carried out immediately after the first rainfall



: Trebinje Municipality, Republic of Srpska,

: 2-10

- 18.37037, 42.6998

: (1.0 km²)

?:

: 10 ( )

(> 50)

/

followed by a warm summer period. This is a traditional technique of karst and bare land management, but new species better adapted to the landscape have been recently introduced.

Pinus halepensis afforested on bare land in Trebinje area (Vasiljević Mirela)

SLM technique "Afforestation of bare land". It is applied on limestone - dolomite soils, very shallow and dry. Stone wall is used for water caption. (Ilić, B.)

- [ ]
- [x] , ,
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- [x] /

/

- [x]
- [x] /
- [x]
- [ ]
- [x]

/ -

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- ( ) / .

Tree types (/):

: , /

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- : Bare land with shallow soils vulnerable to erosion and expressed water deficiency over vegetation period.

: Vegetation is presented by bushes, scarce forest of low quality, exposed to fire, drought and erosion.

- [x]
- [ ]
- [ ]

- [ ]
- [ ]
- [x] /
- [x]
- [ ]

- Wt:

, Wo:

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, Bq: / , Bf:

, Bl:

SLM

- /

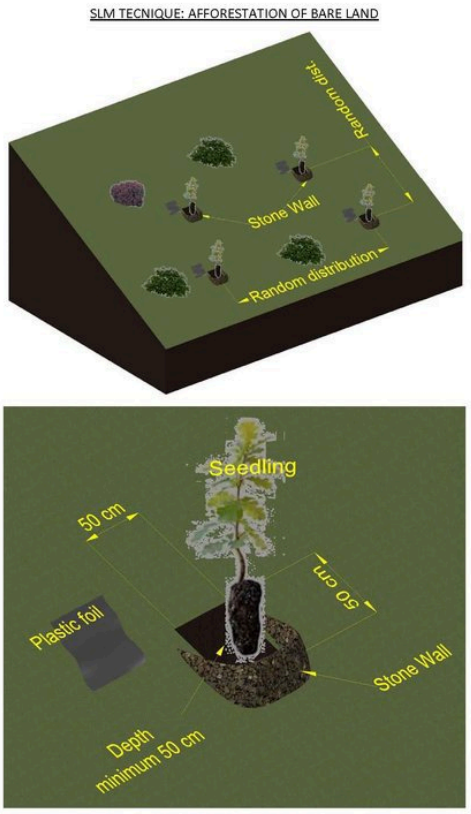
SLM

- V1: , V2:

2

- S6: , ,

The natural conditions of the Herzegovinian karst greatly reduce the range of plant species that could be considered for afforestation. Also, limestone-dolomite soils are usually shallow, dry and xero-termophilic and require irrigation to increase success. Container seedlings whose root system is coated with high quality substrate and protected by plastic foil have been used for afforestation.
The dimensions of each hole are 50x50x50cm. Due to the unfavorable conditions (high level of rockiness, shallow soils, steep slopes, water deficit etc.), around 1150-1400 trees can be planted per hectare. This technology requires manual work, without any use of machines, due to steep slopes and high rockiness. A stone wall is being built at the lower part of the mountain which acts as a barrier. . The role of this barrier is to slow down the water movement down the slope and retain the soil moisture. After having planted the tree polyvinyl foil has been placed in funnel form, to collect rain and create a compact compound of the substrate in the touching zone with the soil around the root. For the Herzegovina area, the best time for afforestation is October and November.
Afforested plants have to be protected from animals at least for the first 3 years. Also, fertilization is applied once per year and mechanic weed control techniques are used for plant protection and treatment of soil surface.



Author: Marijana Kapović Solomun and Mirela Vasiljević

- (**per 1 hectare**) Character of terrain planned for afforestation, costs of labour and plant material. Prices are different every year.
- **BAM**
- ( ) 1 USD = 1.65 BAM
-

1. Preparation work (planning of possible places for afforestation) (/ : September)
2. Digging of holes for plants (/ : September-October)
3. Collecting the stones from the spot and building stone wall (/ : September-October)
4. Afforestation-planting trees (/ : October-November)
5. Fertilization of afforested plants (/ : After afforestation)
6. Metal fences construction for protection from animals (/ : After afforestation (in the first 3 years of life))
7. Re-afforestation (/ : After first afforestation (where it is not successful))
8. Re-fertilization (/ : For re-afforested plants (once))

			(BAM)	(BAM)	%
Preparation work (planning of possible places for afforestation)	hectare	1,0	100,0	100,0	
Digging of holes for plants, collecting the stones from the spot and creation stone wall	hectare	1,0	400,0	400,0	
Afforestation+re-afforestation	hectare	1,0	1150,0	1150,0	
Fertilization+weed protection+construction of metal fences	hectare	1,0	1250,0	1250,0	
Polyvinyl foil	per seedling	1,0	1,0	1,0	
Afforestation + re-afforestation (plant seedlings)	hectare	3,0	2150,0	6450,0	
Fertlization (fertilizers)	hectare	1,0	145,0	145,0	
Protection from animals (costs of metal fences)	hectare	1,0	529,0	529,0	

Transportation costs	kilometer	1,0	5,0	5,0	
				10'030.0	
				6'078.79	

1. Repair/maintenance of metal fences (/ : Over the year)

			(BAM)	(BAM)	%
Maintenance/repair of fences	hectare	1,0	350,0	350,0	
Cost of fences	hectare	1,0	350,0	350,0	
				700.0	
				424.24	

< 250
251-500
501-750
751-1,000
1,001-1,500
☑ 1,501-2,000
2,001-3,000
3,001-4,000
> 4,000

The average annual rainfall is 1680 mm, but with a very unfavorable schedule over the year.Over 60% of precipitation falls in the winter, outside of vegetation period and agriculture production. Only 40% is available for plants from April to September, and drought is very frequent.

Trebinje

The climate in low Herzegovina region, particularly in Trebinje is Mediterranean with short mild winters and long hot summers. The Autumn is much warmer than spring, and snow is very rare. The highest recorded temperature was 42.5°C on July 22, 2007. The lowest recorded temperature was -9.6 °C, January 9, 2017.

(0-2%)
☑ (3-5%)
(6-10%)
☑ (11-15%)
(16-30%)
(31-60%)
(>60%)

☑

0-100
☑ 101-500
501-1,000
1,001-1,500
1,501-2,000
2,001-2,500
2,501-3,000
3,001-4,000
> 4,000

☑

( )
☑ (0-20)
☑ (21-50)
(51-80)
(81-120)
(> 120)

( )
☑ / ( )
(,)
/ ( )

(> 20)
/ ( )
(,)
/ ( )

(>3%)
☑ (1-3%)
(<1%)

< 5
5-50
> 50

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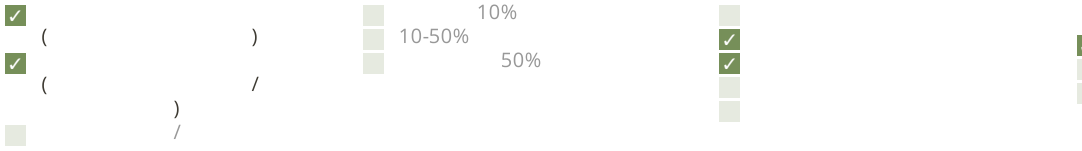
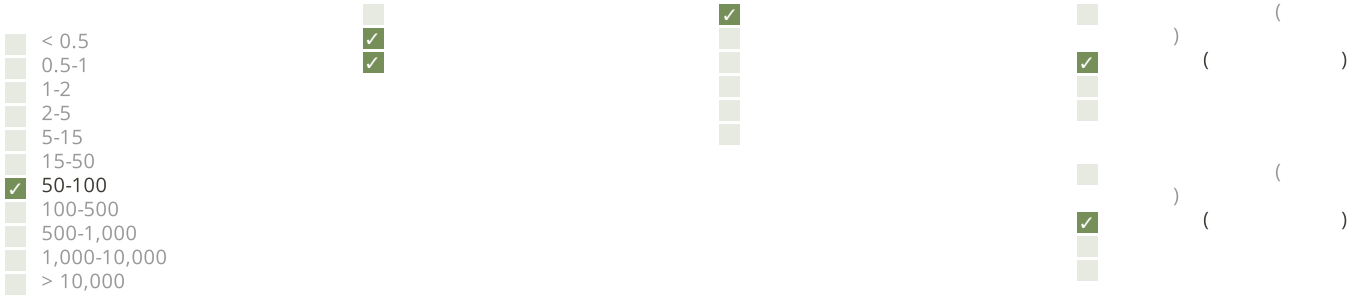
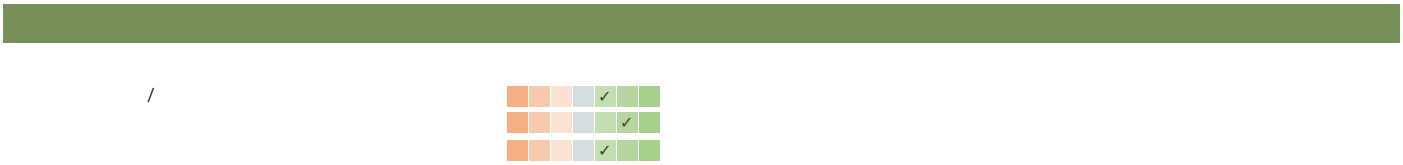
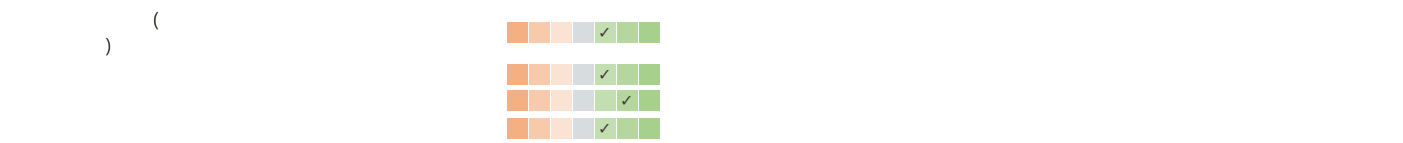
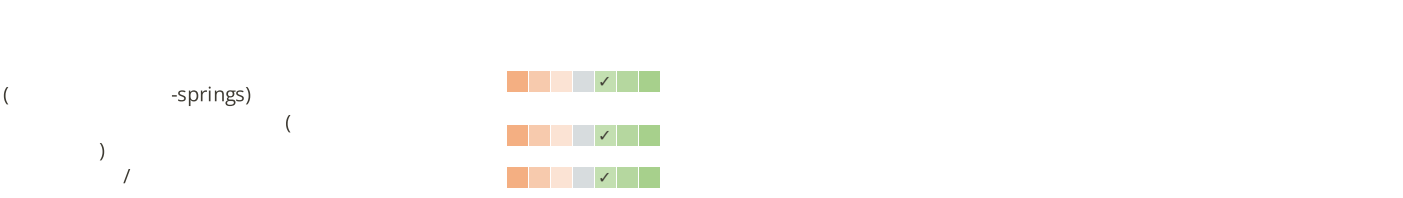
SLM


10%
10-50%
50%


< 0.5
0.5-1
1-2
2-5
5-15
15-50
50-100
100-500
500-1,000
1,000-10,000
> 10,000







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/
- [x] 1-10%
- [ ] 11-50%
- [ ] > 50%

?
- [ ] 0-10%
- [ ] 11-50%
- [x] 51-90%
- [ ] 91-100%

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/
- [x]

?
/
( )

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- Strengths:
  - Soil protected from erosion
- Advantages:
  - Better chance for success of afforestation
- Opportunities:
  - Preserve water resources on Karst

:

/ / :
- Weaknesses:
  Higher costs
- Disadvantages:
  Lower chance for success without irrigation Establish functional irrigation system
- Risks:
  Public awareness for fire prevention Increase public awareness about importance of fire prevention and soil protection.

/ / :

Editors

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: 16 2019

: 12 2019

Mirela Vasiljević -

https://qcat.wocat.net/km/wocat/technologies/view/technologies_4367/

SLM
Approaches: Introduction of Sustainable Land Management to local stakeholders
https://qcat.wocat.net/km/wocat/approaches/view/approaches_4368/

- University of Banja Luka (UNIBL) -
- Decision Support for Mainstreaming and Scaling out Sustainable Land Management (GEF-FAO / DS-SLM)
- Public Forest Enterprize "Šume Republike Srpske": http://sumerepublikesrpske.org/