Contestant profile

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Project overview

Title:	Wild fruitful trees and bushes as element of biodiversity of reclaimed "Górazdże" quarry area
Contest:	Poland
Quarry name:	Limestone Mine in Górażdże
Prize category: (select all appropriate)	☐Education and Raising Awareness ☐Habitat and Species Research ☐Biodiversity Management ☐Student Project ☐Beyond Quarry Borders

Abstract

The aim of biological reclamation is planting trees and bushes in the desired area and by this, making the area the most similar to its natural forest condition. According to the project, the biodiversity of forest plants in the postexploited area of "Górażdże" limestone mine aimed at recreating trees and wild fruitful plants. Introducing fruitful trees and bushes on relatively small areas helped to create "Hot-spots" of biodiversity on the reclaimed land. The species chosen for he project: *Prunus spinosa, Rosa canina, Prunus cerasifera, Rhamnus catharicus, Sorbus aucuparia, Sambucus nigra*, *Crataegus monogyna, Corylus avellana, Malus domestica*, *Pyrus communi* have little habitat requirements and are valuable habitat for fauna and flora growth and development. Planting wildfruitful trees and buhes will reduce the costs of reclaiming the postexploited area which is rational effect for the mine manager. What is more, the ecological potential of biotop will increase. Introducing fruitful trees and bushes is reccommended near technological roads and excavation slopes.

The experiments crried out in "Górażdże" limestone mine can serve as an example of reclaiming process optimalisation accomplished in other mines of HeidelbergCement consortium.

Final report

The main aim of the project was increasing biodiversity of fauna and flora by introducing new wildfruitful species of trees and bushes as a part of biological reclaim of postexploited areas in “Górażdże” limestone mine.

Detailed description of the project

Biological reclaim is defined as introducing trees and bushes to the desired area to make it the most similar to its natural condtion. Forests are perceived as timeless goods, that is why biodiversity ought to serve not only production. The other need is appropriable use created by making natural understory, birds’ nests, forest border plants and groups of plants giving edible fruits. It shows why planting wildfruitful trees and bushes in postexploited areas in “Górażdże” limestone mine will positively influence the food resources for animals, mainly insects and birds. Fruitful plants, their fruit colour, taste and nourishing values also attract other animal species e.g. a deer and doe. The fruits eaten by animals will in a natural process spread to new areas and extend the reach of the species. This can result in plants occurrence growth in the near areas and will increase biodiversity in the following years.

The investigative areas were set on the periphery of already reclaimed limestone mine areas (pic.1). It was implied that the chosen species of wildfruitful trees and bushes would be ecological enclaves for many plants and animals. This would help to protect the biodiversity of the postexploited areas downgraded by the operations of the mine. What is more, significant increase of flora and fauna quality is expected.

For the project a few plant species were chosen: *Prunus spinosa, Rosa canina, Prunus cerasifera, Rhamnus catharicus, Sorbus aucuparia, Sambucus nigra*, *Crataegus monogyna, Corylus avellana, Malus domestica*, *Pyrus communi.* They have little habitat requirements, are mainly photophilous, like dry or restrainedly moist soil and they are resistant to drought and frost.

The methodology of the study

The first stage in the project plan was setting three experimental fields in the reclaimed areas (pic.1). In March 2016 wildfruitful trees and bushes were planted on the fields in such a way that they did not disturb each other and could grow independently. All the experimental plants were covered with the same species: *Prunus spinosa, Rosa canina, Prunus cerasifera, Rhamnus catharicus, Sorbus aucuparia, Sambucus nigra*, *Crataegus monogyna, Corylus avellana, Malus domestica*, *Pyrus communi.* The process of planting was carried out according to forest maintainence rules.

- field number 1 located on the fresh dumping ground characterized by no growing plants (pic.2),
- field number 2 located on the inside three-year-old dumping ground covered by monocyledon and dicotylenodous plants in 60% (pic.3),
- field number 3 located on the inside five-year-old dumping ground covered by plants in more than 70% (pic.4).

The next stage of the work was assessing the plants according to Pacyniak’s scale after 1, 2, 3, and 5 months after planting.

Pic.1. The localisation of examination fields [source: www.geoportal.gov.pl]


Pic.2. Field number 1 during planting process [March 2016]


Pic.3.Field number 2 during planting process [March 2016]


Pic.4. Field number 3 during planting process [March 2016]


Pic.5. Field number 1 during the last assessment [September 2016]

Pic.6. Field number 2 during the last assessment [September 2016]

Pic.7. Field number 3 during the last assessment [September 2016]

The analysis of the findings

The results of physicochemical and chemical analysis of the examined soil show that the fields had very different amount of organic carbon (tab.1). The amount below 1% shows potential inability to accumulate makroelements and little capacity of sorption complex. The reaction was alkaline with little salinity. Small amounts of nutriets (phosphorus, potassium, magnesium and nitrogen) show their significant shortage

Tab.1. Physicochemical and chemical characteristics of the examined soil [March 2016]

Number of field	Depth of taking the sample [cm]	Reaction		Conduction [µS/cm]	Phosphorus [mg/100g soil]	Potassium [mg/100g soil]	Magnesium [mg/100g soil]	Carbon [%]	Nitrogen [%]	Decay [%]
		H_2O	KCl							
I	0-30	7,20	6,28	92	2,2	5,6	2,1	0,66	0,0175	1,14
II	0-30	7,44	7,24	151,5	1,7	9,4	3,4	1,69	0,0147	2,91
III	0-30	7,38	7,14	123	1,1	3,4	1,8	2,11	0,0049	3,64

The soil was characterised by granulometric composition built by skeleton pieces, mostly field number 1 and 2 (tab.2). All the exmined areas can be classified as clay: field number 1: clay, field number 2: light clay, field number 3: sand clay. It showh relatively hard conditions for root growth and development on firld number 1.

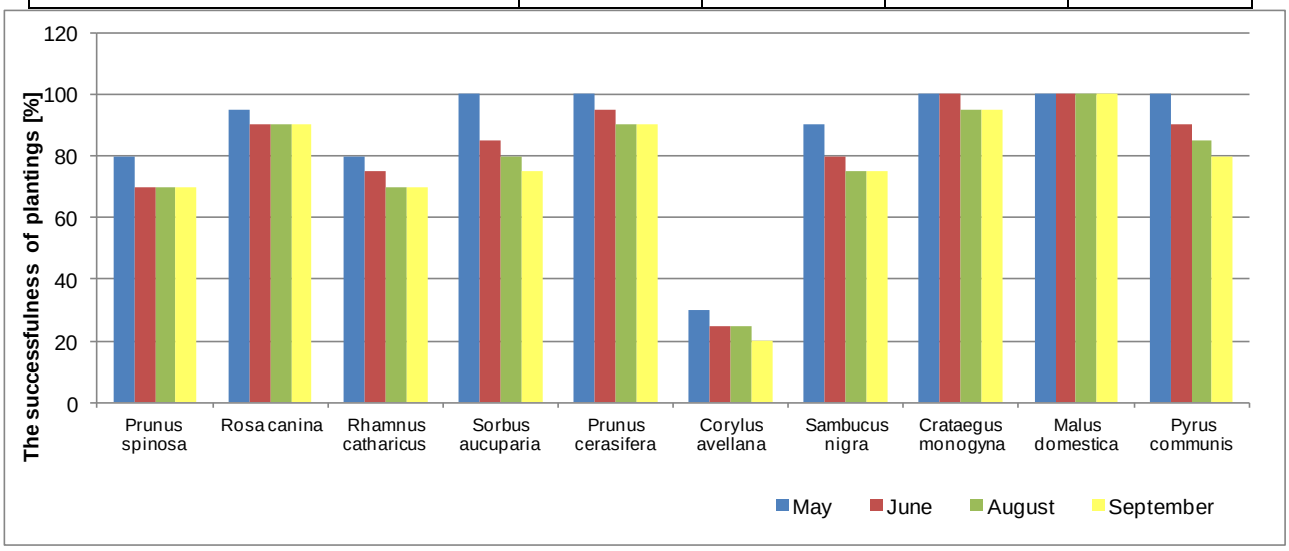
The most successful plantings on field number 1 were: *Malus domestica, Prunus cerasifera Crataegus monogyna Rosa canina* (more than 90% of the plants survived). The least successful planting was *Corylus avellana* (about 20% of the plants survived) (tab.3.).

Tab.2. Granulometric composition of the examined soil samples.

Number of field	Depth of taking the sample [cm]	percentage of fraction [mm]													Group and subgroup
		> 2	<2	2 - 1	1-0,5	0,5-0,25	0,2-0,1	0,1-0,05	∑ >0,05	0,05-0,02	0,02-0,005	0,005-0,002	∑ >0,002	< 0,002	
I	0-30	81	19	7	15	10	9	9	50	16	9	7	32	18	clay
II	0-30	66	34	16	22	7	8	11	64	10	9	6	25	11	light clay
III	0-30	11	89	15	14	14	13	4	60	5	7	3	15	25	sand clay

Tab.3. The successfulness of plantings on field number 1[%]

Name of the species	Months			
	May	June	August	September
Prunus spinosa	80	70	70	70
Rosa canina	95	90	90	90
Rhamnus catharicus	80	75	70	70
Sorbus aucuparia	100	85	80	75
Prunus cerasifera	100	95	90	90
Corylus avellana	30	25	25	20
Sambucus nigra	90	80	75	75
Crataegus monogyna	100	100	95	95
Malus domestica	100	100	100	100
Pyrus communis	100	90	85	80

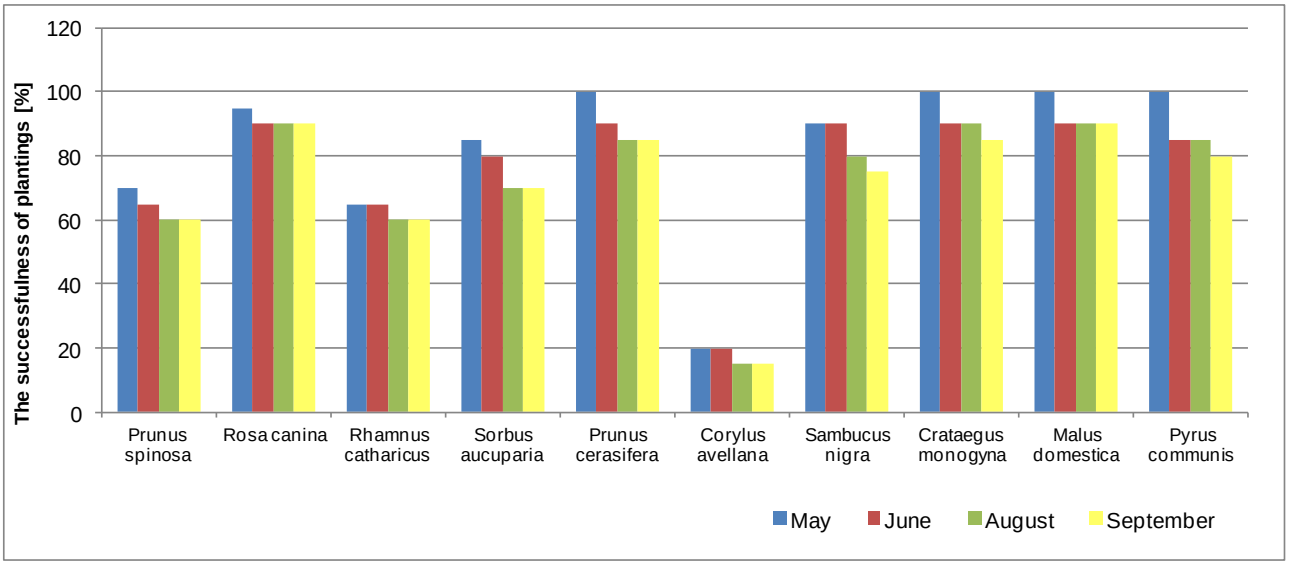


Pic.8. The successfulness of plantings on field number 1 [%]

On field number 2 the most successful plantings were *Rosa canina* and *Malus domestica* (tab.4). Just like above, the least successful plantings were *Corylus avellana.*

Tab.4. The successfulness of plantings on field number 2 [%]

Name of the species	Months			
	May	June	August	September
Prunus spinosa	70	65	60	60
Rosa canina	95	90	90	90
Rhamnus catharicus	65	65	60	60
Sorbus aucuparia	85	80	70	70
Prunus cerasifera	100	90	85	85
Corylus avellana	20	20	15	15
Sambucus nigra	90	90	80	75
Crataegus monogyna	100	90	90	85
Malus domestica	100	90	90	90
Pyrus communis	100	85	85	80

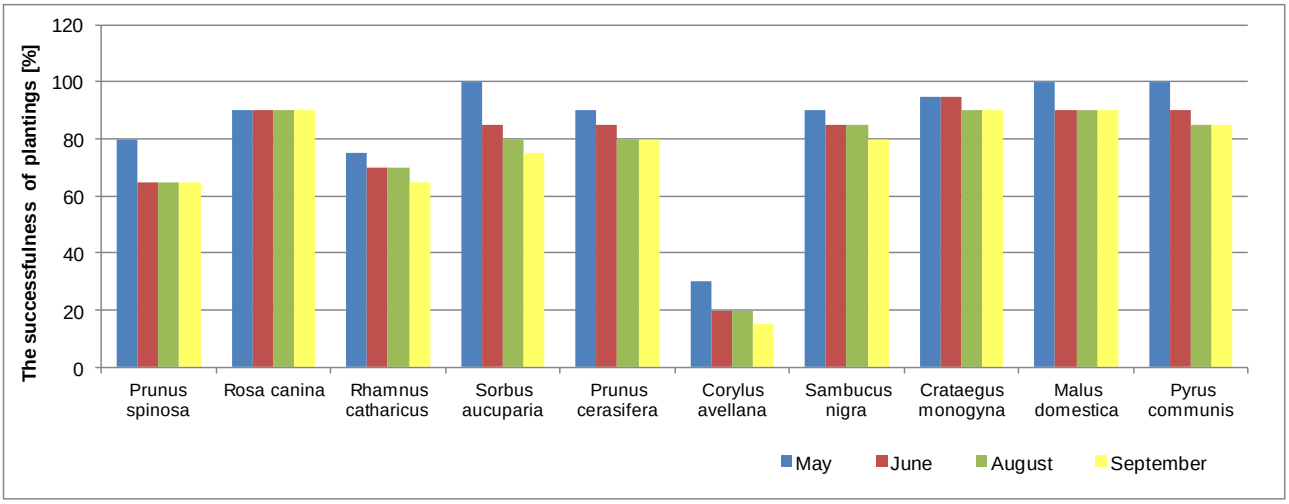


Pic.9. The successfulness of plantings on field number 2[%]

Field number 3 was similar to fied number 2. The most successful plantings were: *Rosa canina, Crataegus monogyna* and *Malus domestica* (tab.5). As far as the least successful plantings are concerned, *Corylus avellana* plants survived in only 15% cases.

Tab.5. The successfulness of plantings on field number 3 [%]

Name of the species	Months			
	May	June	August	September
Prunus spinosa	80	65	65	65
Rosa canina	90	90	90	90
Rhamnus catharicus	75	70	70	65
Sorbus aucuparia	100	85	80	75
Prunus cerasifera	90	85	80	80
Corylus avellana	30	20	20	15
Sambucus nigra	90	85	85	80
Crataegus monogyna	95	95	90	90
Malus domestica	100	90	90	90
Pyrus communis	100	90	85	85



Pic.10. The successfulness of plantings on field number 3 [%]

During assessning the condition of the plantings some dependence was observed. The assessment for field number 1 and 3 shows prevalence of plants with damages from 5 to 15% (tab. 6 and 8). However, on the field number 2 the prevalence of plants with damage from 15 to 25% was noticed (tab.7)

Tab.6. Assessment of plantings damages on field number 1 [24.09.2016]

Name of the species	Assessment of plantings damages [%]				
	< 5	5 - 15	15 - 25	25 - 50	> 50
Prunus spinosa	2	8	4		
Rosa canina	2	10	2		
Rhamnus catharicus		2	4	4	2
Sorbus aucuparia		3	5	3	3
Prunus cerasifera	5	6	1		
Corylus avellana			1	6	5
Sambucus nigra		2	8	2	
Crataegus monogyna	6	8			
Malus domestica	3	5			
Pyrus communis		2	6		
Total	18	46	31	15	10

Tab.7. Assessment of plantings damages on field number 2 [24.09.2016]

Name of the species	Assessment of plantings damages [%]				
	< 5	5 - 15	15 - 25	25 - 50	> 50
Prunus spinosa		5	8	1	
Rosa canina	3	9	2		
Rhamnus catharicus			6	4	2
Sorbus aucuparia		1	7	3	3
Prunus cerasifera	5	4	3		
Corylus avellana			1	4	7
Sambucus nigra		3	7	1	1
Crataegus monogyna	4	8	2		
Malus domestica	2	6			
Pyrus communis		2	6		
Total	14	38	42	13	13

Tab. 8. Assessment of plantings damages on field number 3 [24.09.2016]

Name of the species	Assessment of plantings damages [%]				
	< 5	5 - 15	15 - 25	25 - 50	> 50
Prunus spinosa		7	6	1	
Rosa canina	3	8	3		
Rhamnus catharicus		2	5	3	2
Sorbus aucuparia		3	5	2	4
Prunus cerasifera	4	5	3		
Corylus avellana			2	4	6
Sambucus nigra		2	8	2	
Crataegus monogyna	5	7	2		
Malus domestica	3	5			
Pyrus communis	1	3	4		
Total	16	42	38	12	12

Conclusions and recommendations:

The project of introducing wildfruitful trees and bushes will influence the growth of flora and fauna biodiversity on the reclaimed area of “Górażdże” lomestone mine. This would result in increasing natural and recreational attractiveness of the area. During the study relative successfulness of plantings was observed despite habitat conditions. The trees and bushes in the best condition were:*Malus domestica*, *Pyrus communis, Rosa canina, Prunus spinos,* and *Crataegus monogyna.* It means that the plants can be useful in the process of biological reclamation (instead of forest species), especially on areas with poor soil condition. Planting fruitful trees and bushes will reduce the costs of reclaim, which is definitely positive aspect for the mine authorities. What is more, it will strengthen ecological potential of new biotop in the area. It is recommended to plant fruitful trees and bushes next to technological roads and excavation slopes.

The experiments crried out in “Górażdże” limestone mine can serve as an example of reclaiming process optimalisation accomplished in other limestone mines of HeidelbergCement consortium.