LIFE LAESOE - “Restoration of birdlife and natural habitats at Laesoe”

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Report on control of the invasive Japanese Rose at Læsø

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Naturstyrelsen

Control of the invasive Japanese rose, *Rosa rugosa,* on Laesoe

The Rosa rugosa control project ACTION C4, "clearing of *Rosa rugosa*", is part of the EU-LIFE project "LIFE11 NAT/DK/000893 LIFE LAESOE – restoration of birdlife and natural habitats at Laesoe".

The control project took place in the period 2012 – 2017 on locations within the Natura 2000 sites on Laesoe, which consist of habitat site 10 (DK00FX118) and habitat site 9 (DK00FX010, and SPA DK00FX345) altogether covering about 4.400 hectares. *Rosa rugosa* is combatted onabout 76 ha with scattered and large stands of *Rosa rugosa*, which are mainly distributed at dunes, salt marshes and heaths along the coast.

The deliveries of ACTION C4 have the following preconditions:

- The experiments shall enlighten, which control measures are the most efficient under the preconditions at the site and similar sites.
- The experiments shall engage different measures of non-herbicide control and combinations hereof and include *inter alia* mowing, and grazing as control measures.
- The experimental design shall be replicable on other sites.
- *Rosa rugosa* primarily found along the coastline and in dune areas shall be controlled and eradicated.
- Further spreading of *Rosa rugosa* shall be halted.

ACTION C4 include practical experiences based on the control experiments performed at Laesoe and a manual for best practice based on the results from Laesoe and other pratical experiences together with results from research. In the control experiments on Laesoe a new method and combination of new and well-known methods of non-herbicide pest control are demonstrated.

Background perspective

Occurrence and threat to biodiversity

Rosa rugosa (Thunb.) is native to North East Asia. It was introduced to Europe approximately year 1800 and is presently invasive in larger areas of North-West Europe and North America (Bruun 2005, Kelager *et al.* 2013). *Rosa rugosa* is described being naturalised in Denmark by 1875 (Weidema 2006). Since the nineteen-fifties it becomes widespread due to extensive planting as amenity and shelter species in connection with summer-housings, windbreaks, game shelters and road verge plantings. Today it is the most common invasive, non-native plant species in Denmark (Thiele e*t al*. 2009).

R. rugosa primarily colonises sandy soils, but also occurs on other well-drained soils. It is resistant to salt, wind and drought, and thrives even under conditions with an annual sand apposition of up to 30cm (Belcher 1977), enabling establishment on dune-land, dune heathlands and similar coastal habitats. *Rosa rugosa* is associated with 14 of the 18 light-open habitats surveyed under the Danish national monitoring system NOVANA, being particularly frequent on grey and green dunes and dry,

calcareous grasslands (Bruus *et al*. 2007) and it occurs in 78% of all 5 by 5km squares in the Atlas Flora Danica mapping of the Danish plant species (Hartvig 2015).

Rosa rugosa is listed on the Danish blacklist of worst invasive species under the category: species that can be eradicated locally, but nationally only be maintained at an acceptable level (Miljøministeriet 2017). The rose is in particular a threat to salt grassland, dune heathland and other costal habitats (Isermann 2006, Isermann 2007)which represent the nature in Denmark least influenced by man. It builds large stands, which out-shadow and displace the natural flora and associated fauna, and potentially threatens biodiversity (Frederiksen 2005, Elleriis et al. 2015). The root system of the rose collects nutrients from deeper layers and may results in changes in the soil, which are inconsistent with reestablishment of the original plant societies (Vanderhoeven et al. 2005. Dassonville et al.2008). *Rosa rugosa* hybridises with native roses such as *Rosa mollis* a trait, which present a threat to the species (Kellner et al. 2012). The dense thorny scrub inhibits access and poses a problem for the recreational use of coastal areas. After clearing of the stands dead stem litter with sharp thorns may persist for many years (Weidema 2006).

***Rosa rugosa* on Laesoe**

Rosa rugosa was assessed to cover an area of 23.91 hectare in 2010 on Laesoe (Figure 1). GPS mapping of the occurrence showed that the rose cover was larger, and in total 76 hectares with scattered and large stands of the invasive rose has been eradicated during the LIFE project.

Rosa rugosa in dunes on Laesoe (Photo Naturstyrelsen).

The rose is a threat to habitat types 1330, 2130*, 2140*, 4030 and 6230* as it displace the natural vegetation and spreads very rapidly thereby dramatically reducing the nesting possibilities for

Dunlin, Arctic Tern and Little Tern along the blue coastline. *Rosa rugosa* also increase predation as it provides cover for foxes during their hunt for food.

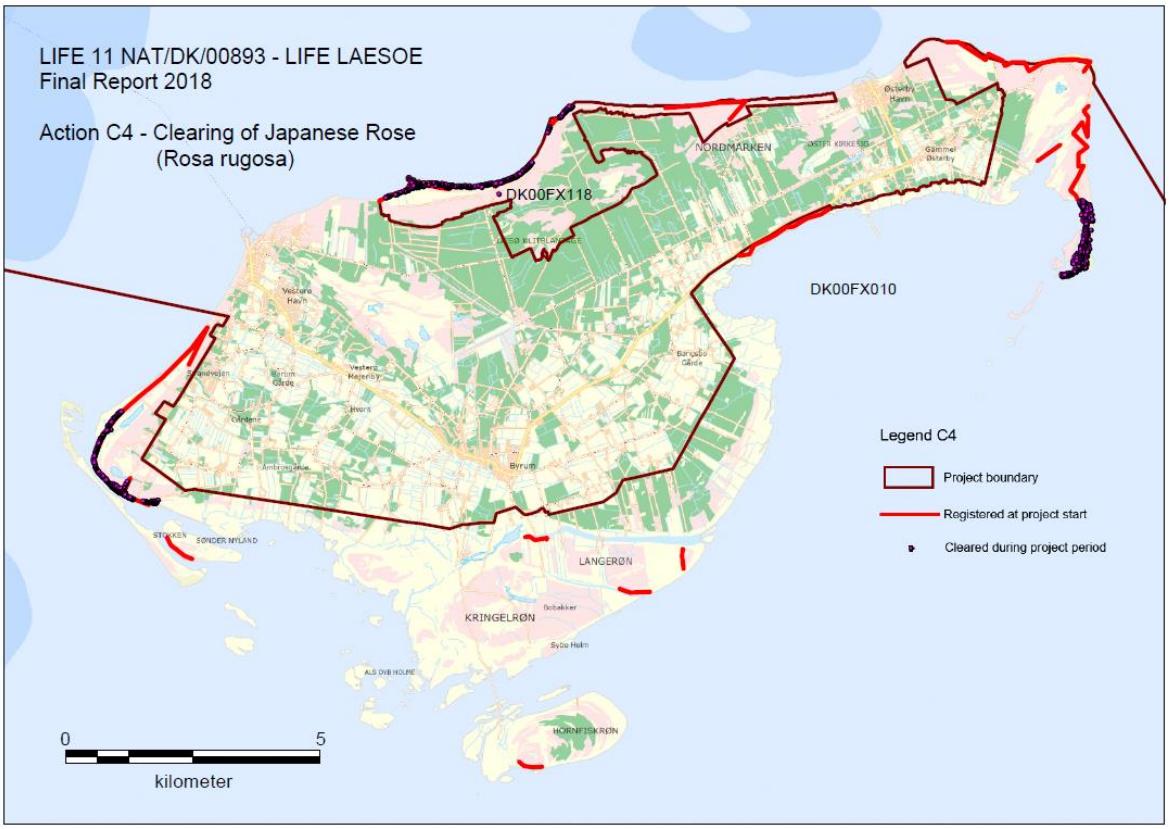

Figure 1. *Rosa rugosa* at Laesoe registered at project start and *R. rugosa* cleared during project period.

Regeneration and dispersal

Rosa rugosa disperses by seed and vegetative, lateral growth. The rosehips contain 20 to 120 seeds (Jessen 1958) and a grown clone produces 600 to 1300 seed per square metre (Bruun 2005). The seeds remain viable in the soil for some years, precisely how many is not known. The seeds are dormant when shed and dormancy is broken after exposure to chill for at least five weeks (Bruun 2005). The seeds are spread via water or animals. The rosehips and seeds float and remain viable after long stay in salt or sweet water (Jessen 1958). Seeds are spread by many animal species that eat rosehips, in particular by birds, but also by mammals, fox, hare, deer, cattle and horses.

Rosa rugosa has a large capacity for lateral spread. Once established, it spreads by rhizomes and builds up large clones of at least 100 square metres (Weidema 2006) with a dense and robust root system (Bruun 2005). The roots normally extend 0.5 – 1.0 m below soil surface, but occasionally down to 2 m (Schlätzer 1974). GPS-mapping of rose stands in Thy in 2004, respectively, 2007 showed that area covered had doubled in the period between the mappings (Stobberup & Kristensen 2007). Modelled calculations based on the two mappings with a baseline in 2004 predict that the number of stands will increase from 1,321 to 18,000 while the area covered will increase from 0.3% to 8.4% within 30 years without management to control (Jørgensen & Kollmann 2009, Kollmann et al. 2009).

Studies on *Rosa rugosa's* dispersal pattern suggests that mainly seed availability due to limitations connected to the dispersal vehicles, water and animals, is a limiting factor in the progressive spread of species (Kollmann *et al*. 2007). The widespread presence of *Rosa rugosa* along with its potency for clonal expansion will result in progression of open-land encroachment as a result of seed germination and lateral growth and be a threat particularly in coastal areas. The only means of avoiding *R. rugosa* encroachment on a site is to eradicate all stands of *R. rugosa* in the areas adjacent to it.

***Rosa rugosa* is difficult to eradicate**

Rosa rugosa is hardy and very difficult to eradicate. Attempts of eradication in practice have often failed. There have only been a few controlled and documented experiments on *R. rugosa* eradication and they often gave unequivocal results (Artmann 2012, Fløistad and Nilsen 2009, Fransen and Hansen 2008, Jensen 2009, Kollmann *et al*. 2011, Madsen 2006, Nilsen *et al.* 2008, Weidema *et al*. 2007).

Selection of control measures at Laesoe

Different control measures were tested in a former LIFE Nature project **"**LIFE08 NAT/DK/000464 Dry Grassland in Denmark – Restoration and Conservation". Results from the LIFE project made it clear that repeated treatments that stress *Rosa rugosa* are needed for eradication of well-established stands of roses (Buttenschøn et al. 2015). The present control project is based on results from the former LIFE-project and other research projects together with practical experiences using a strategy of continued stressing. A new method, mechanical removal of the roses by a plant extirpator, is tested together with methods found to be "best practice" in former projects.

Cutting and herbicide application are the most common methods applied in the control of *Rosa rugosa*. Neither approach has proven fully efficient on the short-term basis. Best practise depends on local nature given conditions and available resources. The use of herbicides to control *Rosa rugosa* is not allowed on Laesoe and the effect hereof therefore not included in the report. Herbicides are generally not used at public owned land and there is a strong opinion locally towards the use of herbicides in nature areas with great conservation interests.

Practical experiences in combating Japanese rose (*Rosa rugosa*)

Mapping of the distribution of *R. rugosa*

All the sites, where *Rosa rugosa* has been controlled, were mapped by GPS to facilitate control management and follow-up treatment (Figure 1). The mapping showed that the total cover of the invasive rose was larger than expected. A total of 76 hectares with scattered and large stands of Japanese rose has been eradicated during the LIFE project.

Information about the control

Many of the areas where the roses have been eradicated are popular recreational areas for the local inhabitants and tourists. The control has set footprints in the landscape. Accordingly, it is very

important that information about the control is communicated widespread. The public general was informed of the project through the project homepage, signs, leaflets, public meetings, excursions and a local stakeholders' group.

Grazing

An important result of the LIFE project was to ensure a long continuation of grazing that could prevent the establishment and spreading of *Rosa rugosa* and other unwanted plants. Additionally, it was important to reduce the need for manual and mechanical retreatment of the invasive rose.

At the beginning of the project the effect of widespread discontinued grazing could be seen on the occurrence of *Rosa rugosa* on Laesoe. The national mapping of light-open natural habitats showed in 2006 that the rose occurred in 25% of randomly tested test areas in the island's southern Natura 2000 site (DK00FK010).

Grazing prevents the invasive rose to spread into the grazed area. (Photo Rita Merete Buttenschøn)

The lack of grazing was a threat to the light-open natural habitats and to many of the area's breeding wading birds. During the breeding season the birds prefer a specific low vegetation height without trees and shrubs, from which crows and other predators can rob the nests.

Grazing on Laesoe was particularly difficult as the privately owned nature areas are divided into narrow land-strips owned by many different landowners, the greater part of which were not animal stockholders. An important task in the project was therefore to secure future grazing management by

setting up an owner association. The owner association has to gather all the small landowners into a co-operative enabling management of the extended open nature areas by grazing with cattle, horses and sheep.

Today the owner association coordinates the grazing of the nature areas in large common fencings. The co-operation between the stockholders combined with the larger enclosures makes it possible to use of the specific qualities of the different kind of husbandry animals to optimise the conservation management in general and steer the control measures on the roses strategically.

The experiences show that hardy cattle breeds as the Galloway cattle browse on trees and bushes. Sheep browse a lot at *Rosa rugosa*, but eat a lot of the flowering forbs as well. Horses do not browse at *Rosa rugosa*, but have a preference for rushes. They avoid many of the flowering forbs.

By choosing the right animals for the different areas, letting them graze according to the need of the habitat, a better nature quality is achieved.

Mowing/cutting

Mowing is used as a method of combating *Rosa rugosa*, where it is not possible to use grazing or as a supplement to grazing. In addition to grazing mowing has been used where the animals do not eat *Rosa rugosa* or where the stand has grown too large and dense for the animals to access and control it.

A large stand of Rosa rugosa outside the enclosure has been mowed (Photo Naturstyrelsen).

The mowing is done with mulcher and tractor mounted or manual brush-cutter. In areas with subsequent grazing, mowing is often done as a one-time only intervention, whereas repeated mowing is necessary in areas without grazing

The average time consumption in areas using a small tractor mounted has been 2.2 hours per hectare. The average time consumption using manual brush-cutter has been 4.3 hours per hectare.

Pulling-up with a plant extirpator

As an experiment pulling-up the roses with a plant extirpator was tried. The plant extirpator is a tool, which has been used in plant nurseries. It cuts the rose free, lifts it and shakes sandy soil off the roots. The roots are left for drying out at the soil surface.

Plant extirpator (Photo Naturstyrelsen).

The experiment with the plant extirpator showed, that the method was most suitable for control of *Rosa rugosa* with a superficial root net in soils consisting of sand and/or gravel.
To optimise the method an extirpator broader than the tractor has to be developed to avoid driving at already treated areas, which might press the cut-off roots back in the soil. The grate carrying the roots while the soil is been shaken-off should also be prolonged to be more efficient.

The average time consumption in areas using the plant extirpator has been 3 hours per hectare.

The picture shows different results of the effect of control management by the plant extirpator. In the right side of the picture the soil is sandy and the dried out roots are laying at the soil surface. Further up the coastline the grass mat is denser and the extirpator has not been able to pull up the roots. The treatment there has only resulted in minor stress of the roses as indicated by the yellow leaves. (Photo Naturstyrelsen).

Every second strip has been treated with the plant extirpator in 2015. The treatment has been effective removing the roses and given space for light-demanding vegetation. The picture shows the treated area in summer2017 (Photo Naturstyrelsen).

Pulling-up with tractor mounted crane

Pulling-up *Rosa rugosa* has been used in several places along the coast where it was possible to go by tractor. A tractor mounted with a crane and a scissor-grip was used for the pulling up the rose bushes. To get the best grip on the roots of the rose, the grip went deep into the ground.

The rose bushes with their root system are pulled up and then shaken free of soil. The plants are subsequently collected and brought away by crane and carriage.
After the pulling-up, the zone around the treated area was examined for root pieces in order to avoid new roses in establishing.

The method has proved suitable in the coastal area where the soil consists of sand or gravel. The reach of the crane is approximately 5 meter, which means that the method also can be used in hilly terrain and on steep slopes with rose bushes other ways difficult to reach.

The average time consumption in areas using the tractor mounted crane has been 1.6 hours per hectare.

Follow-up control of area where the roses have been pulled up (Photo Naturstyrelsen).

Practical guidelines for prevention and control of Japanese rose (*Rosa rugosa*)

The guidelines for best practice is based on the results from the LIFE project on Laesoe and from the former LIFE project LIFE08 NAT/DK/000464 and other practical experiences together with results from research.

Rosa rugosa is now so widespread in Denmark and large parts of the rest of Europe that eradication no longer is a practical or economic option. In order to limit the damages by *Rosa rugosa* on already colonised sites and to prevent it spreading to vulnerable habitats not yet colonised it is necessary to prioritise control management.

Best practice:
Establish an overview of the stands

Provide current information flow and dialogue with the general public

Prevent further spreading

Eradicate new stands as they emerge

Implement a systematic control of stands to be eradicated

Follow-up on finalised treatment at least two seasons post-treatment

Apply combinations of different treatments adjusted to the local preconditions

Establish an overview of the stands
An overview of the *Rosa rugosa* stands, their number, size and position is prerequisite for planning the control. Various methods are being tested, including interpretation of satellite images (Hantson et al. 2010) and registration using drones, etc., as a tool for mapping *Rosa rugosa.*

In LIFE08 NAT/DK/000464 project in Thy, the appearance of *Rosa rugosa* was mapped manually on an approx. 2400 ha of dune space using GPS in 2004 and again in 2007. The time spent on registration and measurement in the field of perimeter of the individual instances took on average about 5 minutes per occurrence.

Communication of information
Many of the *Rosa rugosa* stands grow on private property in the summer-housing areas. It is appreciated by many of the owners because of its scented flowers, the eatable rosehips and properties as windbreak and stabiliser of erosion. It is important to engage the general public in the control programmes, hereunder inform it of the damages *Rosa rugosa* can inflict on natural habitats and distribute information on the characters of the rose. This may assist in preventing the spreading of *Rosa rugosa*, e.g. by choosing not to plant the rose and instead plant native roses and by reporting sites where *Rosa rugosa* grows, making an early control possible.

Prioritising
The following points should be prioritised in connection with the control of *Rosa rugosa*:

- Preventing it establishing at new sites
- Stopping the spreading of already established stands
- Controlling it where it may cause damage

The preventive measures should include initiatives, which may reduce unintended spreading of Japanese rose to vulnerable habitats. New stands should be eradicated before they establish a massive root-net. The control measures should be carried out with consequence and be repeated year after year until eradication has been accomplished.

Long-term programmes for control management
It is necessary to have a long-term strategy and control plan for eradication, which target and prioritise the efforts, and which secure the necessary resources to accomplish the eradication until aims are met. The control of well-established stand takes many years. There are many examples of control measures failing, often due to unsystematic efforts, which have been discontinued at too early a stage. Control without follow-up repetition is at its best a waste of resources; will at its worst trigger accelerated expansion of the rose stands.

The necessity of follow-up
It is important that control programmes are followed up to ascertain that *Rosa rugosa* does not regrow or germinate in the disturbed site after cease of the control measures. The site regrowth monitoring should be continued for at least two seasons after the control measures have stopped.

Choice of control methods
Cutting and herbicide application are the most common methods applied in the control of *Rosa rugosa*. Neither approach has proven fully efficient on the short-term basis. These guidelines do not include treatments with herbicides.

Best practise depends on local nature given conditions and available resources. In most places the most effective control will require a combination of different treatments (Table 1). There are large differences in reports on efficiency from different sites, but only few reports of successful eradication of *Rosa rugosa*.

The efficiency of the methods depends among other circumstances of the size and hereby presumably the age of the individual stand. This was documented in the LIFE08 NAT/DK/000464 control experiments (Buttenschøn et al. 2015).

Methods:

1. Pulling up/uprooting
2. Digging up
3. Cutting, mowing
4. Harrowing,
5. Grazing
6. Covering by plastic or geotextil
7. Burning

Table 1. Overview of control measures minus the use of herbicides

	Primary treatment	**Follow-up treatment**	**Comments**
Small stands	Pulling up manually	Pulling up of regrowth	Treatment will usually eradicate small, new stands within two to three years.
	Cutting/mowing	Covering with plastic foil 3 to 5 years	Follow-up treatment on plane sites with small number of roses.
Large stands	Pulling up by machines: Tractor or mini-excavator mounted crane and scissor-grip Tractor mounted plant extirpator	Grazing	Pulling up weakens the stands and leaves less thorny litter on site, thus leaves the site more accessible for grazing.
		Pulling up of regrowth	
		Harrowing	Draws up most remaining root-net.
		Covering with plastic foil 3 to 5 years	May be applied as follow-up treatment on sites with small numbers of stands of limited size.
	Harrowing with BioRotor	Pulling up of regrowth Harrowing	BioRotor is being tested in some dune areas https://www.youtube.com/watch?v=hxUIbssOlwc
	Cutting/mowing	Pulling up of regrowth Covering with plastic foil 3 to 5 years	Suitable on small stands where soil disturbance is unwanted recommends procedure repeated 7-8 in season for eradication. May be applied as follow-up treatment on sites with small numbers of stands of limited size.
	Cutting 3-4 times in growth season, starting April or May		Cutting will initially stimulate regrowth. The number of seasons with repeated cutting for control and eradication depends on local growth conditions.
	Grazing		Initial cutting of high bushes before grazing may be used, but the thorny cuttings represent a health problem for grazing animals and reduce browsing efficiency.
	Digging up with removal or burial (deep) of dug-out material, conditionally with sieving of soil	Pulling up of regrowth, harrowing Reseeding with grass	Cost-heavy treatment with enormous disturbance of soil and soil profiles.
	Covering with plastic foil or fibertex 3 to 5 years		May be applied as treatment on sites with stands of limited size

Uprooting
Weidema (2006) recommends uprooting as the most efficient method for *Rosa rugosa* control. Uprooting can either be done either by pulling up or by digging up the roses.

Pulling up
Young stands may be drawn up manually, whereas older parts need tractor assistance. The pulling up should be started in June and follow up once or twice during the season (Nielsen 2007), and in the subsequent years until no regrowth occurs (Kollmann et al. 2011). After pulling up *R. rugosa* stands one should survey the perimeter zone (one metre) around the stand for rhizome outliers (Kollmann et al. 2011). It is important that the outliers are totally removed to avoid peripheral regrowth of the stand, as even few cm long root fragments are viable (Kollmann et al. 2009. The pulling up management leaves far less prickly rose-stem **l**itter than cutting, which make the regrowth more accessible for the grazing animals.

Pulling up with plant extirpator
Pulling up *R. rugosa* with a tractor-mounted plant extirpator was tested on Laesoe. The plant extirpator pulls up the rose with substantial amounts of the root-net. The material pulled up is shaken free of soil and brought away. The experiment showed that the method was most suitable for control of Japanese rose with a superficial root net in soils consisting of sand and/or gravel.

To optimise the method an extirpator broader than the tractor has to be developed to avoid driving at already treated areas, which might press the cut-off roots back in the soil. The grate carrying the roots while the soil is been shaken-off should also be prolonged to be more efficient.

The plant extirpator cut the rose bush free, lifts it and shakes sand and soil off the roots. (Photos R. M. Buttenschøn)

Digging up

The digging up of large *Rosa rugosa* stands with an excavator is very resource demanding because of the wide and densely branched of the root-net, which in particular in dunes with concurrent sand apposition may go down from top to 2m in depth (Schlätzer 1974). The dugout soil must be removed, respectively, buried deeply or sieved before it is replaced, ensuring that no roots or stems are left. Jensen (2009) found that root fragments down to a length of 5 cm give rise to new plants and even smaller fragments are viable. The dugout plant material may be burnt, moved away or buried deeply.

Attempts to bury *Rosa rugosa* material in dunes at Tisvildeleje showed that regrowth occurred even after post-treatment by multiple harrowing (Kollmann et al. 2011). Based on the finding of these experiments it is recommended that:

- Digging up is made in the border as well as 1m outside the border of the stand
- Plant material is buried below half a metre's depth
- Burial depth should be increased at sites where dune sand may be removed by wind, water or human activity, and be supported by wind-breaking structures.
- Follow-up treatment by pulling up or harrowing should be maintained until no regrowth occurs.

Digging up is a destructive measure, which ruins the original dune structure and soil profiles (Kollmann et al. 2011). Accordingly it cannot be recommended used at vulnerable sites. However, the flora of the dunes is adapted to very extreme changes in the form of wind-exposure and sand-shift and may thus recover massive changes (Agerlund & Vestergaard 2006). One of the benefits digging up is that the process does not leave large amounts of organic nutrients in the soils, as be the case with for example herbicide application (Agerlund & Vestergaard 2006, Svart 2010).

Harrowing

The Danish Nature Agency, Sønderjylland, has good results with harrowing as a means of controlling *Rosa rugosa* at some beach ridge sites at Trillen on Als. The sites were few and small and placed on a narrow beach ridge zone. The stands were cut before being harrowed, which has reduced the rose regrowth. A dense mat of field-layer vegetation was re-established very quickly on the nutrient rich, disturbed soil (Reimers personel communication).

BioRotor

BioRotor is being tested in different dune areas in Jutland and at Zealand by the Danish Nature Agency. The rosebushes with part of their root net are cut into pieces and left to dry out at the soil surface. The treatment with BioRotor started in 2017.

Demonstration of BioRotor treating Rosa rugosa in dunes in West Jutland (Photo Rita Merete Buttenschøn).

Cutting/mowing

Rosa rugosa may be cut using a tractor mounted or manual brush-cutter. There are variable opinions as to how frequently the stands must be cut to control *Rosa rugosa*, and whether cutting alone is an efficient treatment to control and eradicate *Rosa rugosa* (Eigner 1992, Andersen & Ravn 2007, Madsen 2006 and Fløjstad & Nilsen 2009).

The Rosa rugosa has been cut yearly once or twice for the last 12-15 years. Cutting has developed an open rose stand allowing forbs to live in between the roses. (Photo Rita M.Buttenschøn)

The experiments at Thy (LIFE08 NAT/DK/000464) suggest that early cutting (April and May) are more efficient than late cutting (June and July), but the experiments do not give an answer in regard of cutting used as the only treatment may eradicate the rose, and if so be it, how many years cutting must be repeated before eradication is accomplished. In the experiments the rose stands were cut four times each season with early first cut (April to May), respectively, late first cut (June). The stands were cut with a manual brush-cutter and the cut material was collected and removed. The treatments were repeated annually in 2010-2013. The cutting treatments did not reduce or had only a limited reduction of the frequency of shoots, early cutting having the largest reduction. However, when the effect on the rose stands were indexed by frequency, stand height and leaf-cover (rose-index) the effect of the cutting treatment was not significantly different from that of treatment once or twice a year with glyphosate or the combined treatment of cutting followed by glyphosate spraying.

Grazing

There is a general consensus that husbandry grazing may hinder the establishment of *Rosa rugosa* into pastureland as the experiments on Laesoe also confirmed, but that older, established *Rosa rugosa* stands are eradication resistant to grazing. Bruun (2005) suggests that only newly established stands are susceptible to grazing. However, the evidence from practical management indicates that goats and sheep grazing may effectively control *Rosa rugosa* (Buttenschøn et al. 2015). Lütt (2004) presents results from grazing by Galloway cattle that *Rosa rugosa* conditionally may be controlled by cattle grazing.

Sheep grazing controlling R. rugosa in the Former LIFE project at Thy (Photo Rita Merete Buttenschøn).

The cattle attack the larger *Rosa rugosa* stands from the perimeter and gradually open up the stands, while the field-layer thickens with the opening of the stand. The grazing has appearances of normal cattle grazing in terms browse of *Rosa rugosa* being an integrated part of the general foraging rather than being an attraction. The generally richer field-layer round and in the *Rosa rugosa* stands due foliage litter accumulation increases the grazing pressure at the stands. Similarly, the sheep attack the *Rosa rugosa* stands from without, but they penetrate deeper into the larger stands than cattle do. The browsing of *Rosa rugosa* foliage is selective. In the larger stands some foliage carrying rose stems still protrude above the reach of the sheep. By comparison to cattle and sheep, the goats quickly penetrate into the middle of the larger stands. Browse of rose foliage is an attraction. The goats may conditionally browse standing on hind legs and thus no rose stems are above the reach of the goats.

Sheep grazed Rosa rugosa with some flower carrying stems protruding above the reach of the sheep.

Delay in letting the sheep out one spring gave some regrowth (Photo Rita Merete Buttenschøn).

Breeds of sheep like gute, spelsau and Lüneburger and of cattle like Galloway, Scottish Highland and Dexter, which through years of breeding have been adapted to rough grazing are in particular suitable for grazing of the habitat-type, which *Rosa rugosa* colonise. Horses appear not to be suitable as they mainly eat rose-hips and to a lesser extend foliage and barely.

There are large differences between different herds of animals in regard of seeking out browse while foraging. This is not only race-dependent, but also depends of the herd's experiences with particular habitats and the species they contain. Pasturing of herds with some experienced individuals, in particular experienced lead-individuals, may increase pasture resource utilisation. The browse efficiency is not introduced by force through lack of choice, but by the animal's own experience or learning. Lack of choice lead to nutritional distress and leave animals unfit for the task.

Covering

Covering up of *Rosa rugosa*-stands with geotextile has in experiments carried out at Geltinger Birk in Germany proven efficient in the eradication of the rose after at least 2 years of covering. Preliminary results suggest that there is an intermittent rise in soil nutrients following the break-down of the rose stand biomass. Geotextile may be reused at other sites. The reuse-span is approximately five years when the fibre-mat is not covered to protect from UV-light (Kobarg 2015).

Burning

An experiment with burning of *Rosa rugosa* stand in dunes in its native region promoted growth with emergence of increased amounts of shoots and enhanced growth in height in the years following the burning (Tsuda el al. 1999). Practical experiences from burning trials support these findings (Buttenschøn & Buttenschøn, unpublished data). Thus, burning does not appear to be an efficient method of control.

Biological control

There are a number of noxious species, insects, fungi, associated with Japanese rose, which may weaken it in its native region. None of these, however, are approved for biological control in Europe (Bruun 2005).

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