CRAB APPLE ACTION 18th Jan 2024 Catstrand, New Galloway with Jools Cox McNabb Laurie, and experts in the room and on line

Q1. Ok so why are we talking about Crab Apples?
A.
a) Because the tree is beautiful, bountiful and useful,
offering <u>fruit</u> for cooking,
<u>bark</u> for dye,
<u>wood</u> for instruments
<u>food</u> for animals
and it is used in herbal medicine

b) Because it is one of the few 'true' native trees of Scotland. It's the least understood and a very much under appreciated native tree.

Because before the recent 'Darwin Tree of Life' Genome project sparked interest, there were no scientific papers or articles on the ecology or genetics of crab apples, and although it one of the oldest of Scottish native trees it is not even listed as such, even by the Forestry Departments.

c) These wild apples although small and green and sour, have genetic qualities that could prove beneficial to future domestic apple breeding.
They seem to be disease resistant, pest resistant,
Have adapted to adverse climate conditions, useful traits to mitigate against climate change, and essential if virus or bacteria wipe out the domestic inbred weakened varieties.

That means their unique, natural genetic diversity is vital to food security.

d) Wild forest apples are central to many myths, legends and traditions, these stories were often about the 'wild apple' they are part of our culture and heritage.

e) The humble Crab Apple is under threat!! the genetic integrity of the trees, is being undermined by hybridisation, that is cross pollination with domestic apples and the introduction of hybridised varieties bought from nurseries.
Also, they are being scrubbed up and tidied away. Shrubby knowes of gorse, hawthorn and often Crab Apple, are being flattened to make way for silage.

f) But the main reason we are talking about them now and why we need to act, is that we have found that we have a high propensity of pure true wild natives in Galloway.

We are a hotspot for a species as rare and as endangered, as the Wild Cat in the Highlands,
Our trees need our protection and care, it is our duty to look after this precious resource

Q2. So tell me a bit about Crab Apples before we get onto the project and results!

First let me say what we are not talking about.
We are not talking about the ornamental John Downie and Golden Hornet,
not the crab apple in gardens and parks,
not even the roadside, sometimes slightly bigger crab apple usually hybridised from the domestic apple.
These are all wonderful trees and have the same uses and many benefits as the wild tree and are probably descendants of the wild tree but….

It's the 'native forest wild apple' we are talking about here. *Malus sylvestris* European Wild apple belonging to the Rose family, one of the first plant families to colonize after the ice age, and a native in Northern Europe.

It has many names Wild Apple, Forest apple, Aball (Irish) Gribble, Grindstone Apple, (the wood is very hard and was used for small instruments and sharpening knives,
Scroggie, Bittersgall, Wilding tree,
Griggles- (small apples left on the tree after leaf fall), and no doubt many other regional names.

So it is *malus syvestris The* latin word *malus* means bad, evil, seen as a negative, malignant, malnourished, malfunction. but *malum* another Latin noun taken from the Greek means apple!
The *sylvestris* translates as *sylva* meaning wood, *vestris* refering to the manner of growth, being scrubby, gnarled, twisted, crabbed. Twigs often develop spines giving a crabby nature.

So, the crab apple has a poor press, evil and scruffy, if you are feeling grumpy, nippy, possibly a bit sour, you may say you are feeling 'crabbit'!
Perhaps this is why, despite being one of the prettiest and a highly productive native tree of Scotland, the Crab Apple is the least understood and very under appreciated.

Despite being found in ancient woodland remnants, all over Britain and northern Europe.

Q3. OK how can we identify a 'wild apple'

A. *Malus sylvestris* It is a deciduous, broadleaf, dome shaped, slow growing tree and grows to 10-15m.
Wild crab apples can be found on their own In ancient woodland or remnant ancient woodland, sometimes alone in a pasture, sometimes mixed with Hawthorn, gorse and broom on scrubby knows.
but also in clumps due to a habit of suckering,

<u>Leaves</u>
The green, glossy, oval leaves up to 5-7 cm with rounded triangular teeth, alternate on the shoot, and distinctively, the underside has few or no hairs.
Domestic apples often have a downy underside.
The leaves are often curled or appear crumpled. The leaf stalk is 2-3cm long, and spur shoots may bear a thorn. The bark is smooth and green/ brown with large, orange breathing pores (lenticels) older trees have scaly ridges. Buds are reddish.

<u>Blossom</u>
The blossom consists of white or pink flowers in clusters of four to seven appearing with the leaves in May and stands out in its own glory until overwhelmed by the slightly later flowering Hawthorn.
It is sometimes difficult to spot in a mixed woodland as the blossoms are often above the tree canopy.
They are often covered with bees.

<u>Fruit</u>
The globe shaped fruit, 2-3cm are yellow/green sometimes flushed with red, small and hard and carry the remnants of the flower, they have a sharp, dry and slightly sour taste when raw.

Fruits can be gathered September to October and may stay on the tree until the following spring withstanding the fiercest of gales. In winter the bright yellow/green 'crabs', often flushed with red, become obvious like ornaments on the tree, and litter the woodland floor.

When old, limbs often split out, fall, and produce a phoenix tree where limbs touch the earth and reroot.

Even when old and hollow they can carry on reproducing and are very resilient to disease, pests, adverse weather and salt.
Many of our checked pure specimens on the coast are growing in sand and shingle and blasted by salty westerlies.
Yellow crab apples in amongst the white cockle shells is a sight to behold!
The trees are long lived some 100-200 years old, some have a girth of at least one and a half metres. We had several that size in our survey.

Q4. What are it's uses?

A. There is evidence of longstanding use. Wild apples have been found in Neolithic and Bronze age sites across Europe
<u>Woodworking</u>
The timber of the crab apple is uniform and dense in texture and if dried slowly, is excellent for woodworking. At one time it was used for making set squares and other drawing instruments and used for sharpening tools.
<u>Dyeing</u>
The bark produces a yellow dye for wool or cloth.
<u>Inks</u> Ink can be made from the bark and leaves. Ed and Lucy at the Old Mill Gallery Palnackie run excellent courses called Trysting Trees and teach artists how to make sustainable art materials.
<u>Pollinators</u>
Bees frequent the blossoms freely and crab apples are often planted in orchards to help cross pollinate orchard fruit. Crab apples increase the biodiversity of hedgerows and woodlands.
<u>Food for wildlife</u> Fallen fruits are foraged by cows, horses, badger, rabbit, hare, deer, voles, mice and the empty shells indicate squirrel activity searching for pips.
<u>Cooking</u>
The Celts and Vikings would have made the fruit more palatable by fermenting, drying and cooking the fruit with natural sugars.

Today we make jams, jellies, fruit cheese, wine, cider, cider vinegar, we could make Gallvados why not?
They can be dried to use as a tea and made into an edible fruit leather.
The High Pectin content of crab apples means they are a good addition to any jam ingredients to aid setting.
Toffee 'crab' apples were sold at fairs by traveller folk. Picked from hedgerows they were skewered and dipped in toffee. The word 'Lollipop' comes from the Romany *lolla* for red and *poppel* for apple
<u>Medicinal uses</u> _ There is a Bach Flower remedy made from Crab Apple used to cleanse body and mind, and crab apples used as a poultice are said to cure cramps and sprains.

Q5 How and why did the project start?

A. Well, we have to go back to 1992 when UK signed up with the Rio Biodiversity Convention to conserve species and conserve genetic diversity. This triggered many people to think about local plants and their genetic make up.

In 2016/17, Rick Worrell and James Renny conducted a survey of wild forest apples in Scotland (lots in Galloway) collected leaf samples and had them DNA tested by Markus Ruhsam at the Royal Botanic Garden Edinburgh.

2018 Rick and James returned to Galloway with the interesting and exciting results. The DNA analysis showed that most (more than 75%) of the Galloway crab apple samples were native Scottish forest apples. This threw up lots of questions, how long have they been here, why have they not hybridised like most others in the UK, how are they distributed, what are their favoured locations? Could Galloway be a hotspot for native pure crab apples? What do we do with this knowledge and how do we proceed?
Lots of questions had to be answered and the data analysis expanded.

In 2021 The Darwin Tree of Life project was launched by the Wellcome Sanger Institute to sequence the genomes of 60,000 species in UK to date 25 apples including the crab apple have had their genetic 'blueprint' sequenced by the Royal Botanic Garden Edinburgh.

It was time for a local project to identify our local native crab apples and preserve the knowledge and the seeds for the future.

March 2022 the project stepped up a gear with £5,000 funding from Galloway Glens Landscape Partnership
Myself, and Jenny Stephenson of 'South West Community Woodlands Trust', with help and expertise from Mas Smyth and Richard Cunningham undertook furthering the project to encompass - the community, education, cultural heritage, food futures, climate change, social history, art and wellbeing.

There were so many aspects of local crab apples to be explored each question leading to another, but the first thing was identification, collection of leaves in the summer and further DNA testing.

In early July 2022 volunteers 'citizen scientists' were given guidelines Trees in remote locations, with small glossy leaves, not much, if any, down on the underside, short stems, sometimes thorny branches, small green or yellow/red hard apples, and asked to collect a leaf from trees in their location.
The location of the tree was recorded by OS grid reference. The volunteer 'Citizen Scientists' put the leaves in plastic bags with silica gel, labelled with location and we sent them for Genotype/DNA analysis by Edinburgh Royal Botanic Garden scientist Markus Ruhsam.

Q6 what were the results?

A. The results came back and were very exciting. Out of the 113 samples tested 92 were definitely native *malus sylvestris.* 81% of our samples. A very high propensity compared to other locations in northern Europe.

March 2023 We have had interest from Gayle Volk US Dept. Ag. who asked for seeds for their seedbank, and |Nick Howard in the Netherlands who wanted leaf samples of our natives for a genetic mapping of crab apples in Europe. The research goes on…

Q7 The question that follows is, why here?
A
We can only speculate.
a) Most of the trees are on the west coast and bees don't tend to fly against the prevailing wind if they can go elsewhr

b) Most of our trees are far away from domestic or ornamental apples, there has not been an orchard culture in Galloway.
c) They are resilient and can brave the westerlies, sea salt, being nibbled again and again by sheep and deer
d)They are often protected by hawthorn their favoured companion and spiky protector.
e) Cattle grazing is of a lower density and they may have been spread by cattle eating them and distributing the seeds in cowpats that in turn act as nutrient and protection.
Fewer sheep 100 years ago more of a cattle culture?

Q8. What are you doing next, and what can landowners and citizens do to help?
A
We are growing native crab apples from seeds from trees that are DNA tested, surrounded by other native trees and far away from domestic trees. Markus says at least 500m away from any suspected non native trees or domestic trees. I'd say as far away as possible.

These seeds take a year to get to approx. 10cm tall, they are then planted in a nursery bed protected from voles and deer.
When 20 cm tall they will be planted out, with landowners permission, in remote areas away from non native trees.
We will try and monitor the trees we know about and seek out more and we continue to gather and redistribute seed.
Perhaps we will get the opportunity to DNA test more trees.

Farmers and landowners can keep an eye out for crab apples on their land, ensure that they are protected and the surrounding ancient woodland remnants preserved if possible.
To increase the number of trees, crab apples can be randomly placed in cow pats, if there are low grazing rates and no sheep!
Cows and horses pass seeds through faeces and crab apple trees are spread this way, the cow pat offers perfect protection and provides nutrients.
Trees can also be grown from DNA tested tree seeds, then planted in mixed hedges and small woodlands.

****Sam Boley has some experience on the farm he manages near Dumfries for Percy Weatherall. And Mas and Richard are wilding an area of their farm and the cows are helping seed the crab apples**
They will tell us about their experiences later.

If land has several trees, approx. 50 you can register them with the European Forest Genetic Resources Network (Eurforgen), and set up a 'Gene Conservation Unit', you follow the guidelines for estate management and help genetic conservation. So far the Crab Apple hasn't been registered with a research plot but Mas and Richard hope to change that.
Other sites that could be included in the scheme are Torrs Point Auchencairn, Borgue and Almoness Point. All have the requisite amount of trees and the perfect environment.

People without land can gather crab apples in the autumn from trees that we have identified as pure native, (check the OS reference on the swcwt website or the D&G Woodlands website)
Grow them on and plant out
Protect in early years and let us know the location.

We have a vision of the Galloway Hills and beyond being covered in 'wild apples' as are the mountains of Kazakhstan.

And we want to designate 15th May Scotland's Day of the Wild Forest Apple.

So, Let's just go back to why we are doing all this and then I'll let others have the floor!

Wild Apples seem to be disease resistant, pest resistant, and have adapted to adverse climate conditions, useful traits to mitigate against climate change, and essential if virus or bacteria wipes out the domestic inbred weakened varieties.

Their unique, natural genetic diversity is vital for food security. They have to be revered.

Q Let's talk to Sam now and find out what he is doing on the land he manages.?
Sam answers

Q Ask Mas and Richard if they would like to comment on their 'wilding of ex sitka forestry and the role the cows have in seed distribution

Q To Jools Can you buy native crab apples anywhere? How do you know they are pure stock?

I can answer and RICK WORREL could perhaps add a comment

Malus sylvestris **trees are advertised in tree nurseries but it is very hard to know if the trees you are being sold are pure. As *Rick Worrel, Markus Ruhsam and James Renny* discovered when they did extensive research into nurseries selling wild apple *malus sylvestris*, they show in their paper *(ref on website)* that here were only two nurseries that sold pure specimens.**

The Scottish nursery that you can get pure plants grown from gathered seed from known tested natives from is Eadha Nurseries, a Social Enterprise run by Peter Livingstone, that specialises in Aspens and rare native trees. *Ref on website*
They have a small amount of surplus Galloway provenance saplings, maybe around 100 Peter says ' its nice to hear that our humble wee nursery is known about'.

Our prices for Wild Apple are:

20-40cm £1.67 40-70cm £2.83 70-100cm £4.01

Questions from the floor ?

Round up !

Q and believe you have a sales pitch?
Yes, finally a plug for our beautiful tea towel designed by Ross Fleming.
It has a pictorial map of locations of the DNA tested trees,
a unique recipe,
it depicts the myth of the Irish prince Connla the Fair, being tempted by a faerie queen who offered him an apple promising everlasting life. He took a bite and was hers forever, they sailed to her magical island where trees bore fruit and blossom all year round and winter never came. They ate apples and stayed forever young.
'An apple a day keeps the doctor away!' Please stay and chat

Additional info

Optional info?

Domestic, cultivated, varieties made their way from East Asia along the silk route as the result of passing traders and animals. A 2012 study by Amandine Cornille, Upp sala University, Sweden, suggests that *Malus sylvestris* was a major or secondary contributor of genes to the modern domesticated apple as far back as 1,500 years ago, and in fact *Malus domestica* is now thought to be more closely related to *malus sylvestris* than to its original ancestor *malus sieversii* from the Tien Shan mountains.)

<u>Grafting</u> onto domestic apple rootstock ie M26 has worked and is used in some nurseries using top growth as future graft material, the top of the tree will be true and the seeds will be true. However if the tree is planted in the wild and bottom growth from the rootstock is not checked it may quickly revert to its parent and the pureness would be gone. *Rick Worrell perhaps you could comment?*
<u>Suckers</u>, from a tested pure native, which are in effect clones of the parent can be used to grow on.
<u>Self fertile</u> -Wild apples are hermaphroditic ie have both male and female reproductive parts, and are monoecious (mon ee shus) – have both male and female flowers on the same tree but not always on the same flower therefore they are assisted by pollinators, usually bees to reproduce.

References:
All Project info and the OS references of locations on D&G Woodlands website

To be put on the website on Thurs morning.

Agricultural Research Service at US Department of Agriculture ars.usda.gov 'Using ancient apples to improve the future of apple breeding'

Reforesting Scotland (Autumn/Winter 2017) Issue 56
The Search for Scotland's native forest apple: *Malus sylvestris* Rick Worrell

Markus Rusham, James Renny Rick Worrell (31st Oct 2022)
Verification of Wild Apple(Malus sylvestris) nursery stock sold in United Kingdom
Plants,People, Planet/Vol 5 Issue2 / p203-208

Dr Mas Smyth FRSGS (2023)
'Evolution in future forests'
The Geographer, P.12 Winter 2023

Thomas Sim Forest Research Gene Conservation Unit
thomas.sim@forestresearch.gov.uk ask for the Guidelines

Eadha Enterprises 01505 844827 contact@eadha.co.uk
Source of pure Crab Apples and Aspen

Check out
Wellcome Sanger Institute Darwin Tree of Life Project