RC3: ['Comment on bg-2023-19'](), Anonymous Referee #3, 06 Sep 2023

The researchers studied the extent of a fire on the island of Stromboli and its effects on the vegetation cover, as well as its recovery using NDVI and dNBR. They conclude that, although half of the vegetation of the island was affected, the alien species Saccharum biflorum experienced a fast recovery and dominated the area, occupying also the patches with former native vegetation.

Overall, I think it is an interesting topic, relevant to address, but, in my opinion, the researchers could go further in the study, it lacks challenges. The study shows the vegetation cover affected and the great capacity of Saccharum biflorum for recovering. However, it does not contribute with deeper ecological knowledge or new methodology. There is a lack of statistical analyses (e.g., differences on stem density), there is no data about the area covered by native vegetation before the fire and after the fire. Although in the abstract the researchers introduce the intensity as a study variable, it is not addressed. Alteration of the ecosystem functioning and structure is mentioned but there is no discussion about how they are altered. The writing style is too colloquial in some parts. In the methods section, there is no need to explain so much about the basic remote sensing techniques (blue, green, red channels, …). In addition, there are some parts of results that should go in methods.

The researchers talk about the effect of more frequent fires, but they do not give data about fire frequency in this area. They also affirm that local vegetation outcompetes in the long term the alien species, but this is bases on a photography without being analysed. I would suggest trying to quantify the covers in the photography, or search for orthophotos, if they exist and try to collect photos at different years to see how the replacement evolves.

Many thanks for your careful reading of the manuscript. We will address all of your suggestions. In particular, we will test the homogeneity of variance and the correlation between vegetation types and the fire intensity and we will check the significance of the differences on stem density (Tukey's HSD, P < 0.05). As for the vegetation recovery, in order to provide more circumstanced results, we went to Stromboli in the first half of September 2023 to make additional surveys in the study area. We are now checking whether the data collected have enough resolution to implement the paper with an analysis of the variation in the area of occupancy of the main vegetation units in the burned area (Maquis, Garrigue, Saccharum) before and after fire, as well one year after the previous survey. This would substantially improve the content of the paper and make it much more focused.

I think the manuscript needs more work. At the moment, is very descriptive and more interesting information can be extracted.

I show my specific comments in the following lines.

Title

I would not use the noun "facilitation", but "favouring" or something like that.

Ok, we will replace "facilitation" with "regeneration"

Abstract:

- Line 17: I think the intensity of the fire is not addressed in the study.

Ok, not intensity, but severity based on dNBR thresholds proposed by the European Forest Fire Information Service (EFFIS, 2022). We will mention the reference in the text and test the correlation between vegetation types and fire intensity.

- Line 25: arson is too specific as it refers to an intentional fire. The species benefits of fire, independent of intentional or natural.

Ok, we will replace "arson" with "fire"

- Line 27: "few months": be more specific please.

Ok

- Line 28: "recurrent fires" Could you give information in the section of study area about the fire frequency of the area?

No, unfortunately we do not have these records

- Line 29: the impact in the structure and function is not studied. No data is shown about the plant communities in control areas or before the fire. After fire, the area that was with the invasive species is again with the invasive species. No data about functioning is shown.

Ok, we will be more nuanced on this point. However, we do have data on the vegetation cover before the fire and we will add a vegetation map. You are right, after fire, the area that was with the invasive species is again with the invasive species, but after one year the area of occupancy enlarged. As written above, we went to Stromboli in the first half of September 2023 to carry out additional field surveys in the study area, so to provide additional data on this point.

There is no explanation about the natural succession progress if the alien species would not be there.

We will add some sentences on this topic in the discussion, even if it is out of the scopes of the paper

We do not know when agriculture was abandoned and if patches with this alien species have been replaced by natural vegetation, after how much time and the characteristics of these areas.

It is hard to get precise records on the abandonment of agriculture, but as far as Saccharum is concerned, there is a strong indication that its area of occupancy could be largely dependent on the fire frequency. Two vegetation maps of Stromboli, published by Richter and Lingenhöhl (2002, Fig. 4), compare the vegetation cover in 1984 and in 2002, after 18 years of no destructive fires, showing a clear reduction in the areas occupied by Saccharum, in favour of native vegetation (garrigue and maquis).

- Line 34: try to measure the evidence that this alien species is replaced by natural vegetation with time. After how much time?

Within a few decades, as we wrote. Unfortunately, we cannot be more precise on this point.

Introduction

- Line 53: specify the characteristics of the areas that are affected by climate change in this way.

Ok

- Line 56: "changes in fire regime resulting in shorter fire intervals". This depends on the place. There can be fewer fires, biomass accumulation followed by very big fires but less frequent. Is the first one the case for Stromboli?

We don't know. The fire frequency in Stromboli is variable and we do not have precise records on it.

- Line 60: I would start the new paragraph about islands and Stromboli from "Small islands …"

Ok

- Line 67: I would specify that this alien species is invasive.

Ok

- Line 72: "somehow" instead of "somewhat"? Do you have any idea which factors could have enhanced the development of native scrub?

Ok, "somehow". Our idea is the lack of human disturbance and a decreased fire frequency, as suggested by the study published by Richter and Lingenhöhl (2002), mentioned above.

The areas that were burnt, were cover only by Saccharum biflorum?

No. We will try to be clearer on this point

I think specific questions, objectives or hypothesis are missing.

Thank you for this suggestion. We will substantially rewrite the final part of the introduction also following the suggestions of Reviewer 1

Methods

- Line 91: What do you mean by "smooth texture"?

It refers to the geomorphological concept of surface roughness.

- Line 102: how much vegetation cover correspond to Saccharum biflorum?

We will quantify this and add a pre-fire vegetation map

- Line 114-122: It is not necessary to explain all the details about the images of Sentinel-2. I would give only the most relevant information: Sentinel-2, resolution, …

Ok, we will shorten this part

- Line 131-134: too much explanation about the bands used for real colour images

Ok, we will shorten this part

- Line 137: no need to specify the bands corresponding to SWIR and NIR in Sentinel-2, only the equation of the index.

Ok, we will shorten this part

- Line 141: "… estimate biomass loss": do you estimate this? There are no results for this variable.

No, we don't, we will replace "biomass loss" with "vegetation loss"

- Line 146: Is it possible to differentiate through the signal the recovery of Saccharum biflorum and the native flora?

We are preparing a new version of the manuscript in which the images are classified according to vegetation units (Saccharum-dominated patches, garrigue, maquis), in order to detect Saccharum in the different stages (before the fire, right after the fire, and at different stages of regrowth).

- Line 175: I would remove all the paraphrase and focus on the fact that Ferro and Furnari reported the species at those locations.

We prefer to report the sentence by Ferro and Furnari, because it sets the Saccharum ecological behavior so well.

- Line 180: Is it not possible to measure the cover in the photos or, are there orthophotos available to be more precise?

This would be out of the scopes of our study

I would change "somewhat" for "somehow"

Ok

- Line 182: I would explain, if there is information, how this species is favoured by fire

Ok

- Line 183: it would be good to have a map showing the sampling plots and also to specify the plot size, minimum distance between them and the design (randomly distributed, following by a pattern, …). Also to specify if they are in similar environmental conditions.

Thank you. We will add methodological details on the fieldwork and the location of the sampling sites

Statistical analysis is also necessary to determine the differences between number of stems and percentage of dry stems between burned and unburned areas.

We will run a Tukey's post hoc test and integrate the results in figure 3.

It would also be important to assess the area of native vegetation lost and replaced by this alien species, and if the stem density is similar in the areas occupied previously by S. biflorum vs. areas occupied by natural vegetation.

We will do it

Results

-Line 192: NDVI values strongly correlated with dNBR values. Which correlation did you use? Could you show the graphic of the correlation or the parameters of the correlation?

We will put the results of NDVI and the graphic of the correlation in an on-line supplement, as suggested by Reviewer 1

- What is the advantage of using both indexes?

No advantage. We were interested in offering the reader a case study demonstrating the superiority of the dNBR over the NDVI for identifying and quantifying fire damage

- Line 215: I would not speak about biomass loss but cover loss.

We agree (and modify the text accordingly)

- Line 220: could you give an area or percentage of the native vegetation patches affected? How did you get this information, with the Sentinel image pre-event?

We will add data on the vegetation cover before the fire and a vegetation map of the burned area.

- Line 223: This sentence is too colloquial

We will rephrase it as follows (as suggested by Reviewer 2): "The fast recovery of *Saccharum* patches was evident by the stark contrast between the green colour of *Saccharum* and the surrounding black/burned landscape - further emphasised by the particularly hot and dry summer of 2022."

- Line 226: after 12th August, which other species appeared? In which order? How much cover after a period of time (if you have this data, I think you have it until 22nd May)?

We have these data, but we think that they are not relevant for the scopes of this paper.

- Line 229: How do you know that the regrowth is mostly Saccharum biflorum? With the drone images? Explain briefly.

We will explain briefly

Discussion

-Line 189: how did you decide the threshold value of 0.19? Do you have references from other similar studies to know which threshold do they use?

We agree this should have been better clarified. We actually started from the widely used definition of burns severity classes from Keeley (2009): https://pubs.usgs.gov/publication/70032718

We used then the following reference to obtain our first map with hard classes (below, not reported in the paper)

	Severity Level	dNBR Range (scaled by 10^3)	dNBR Range (not scaled)
	Enhanced Regrowth, high (post-fire)	-500 to -251	-0.500 to -0.251
	Enhanced Regrowth, low (post-fire)	-250 to -101	-0.250 to -0.101
	Unburned	-100 to +99	-0.100 to +0.99
	Low Severity	+100 to +269	+0.100 to +0.269
	Moderate-low Severity	+270 to +439	+0.270 to +0.439
	Miderate-high Severity	+440 to +659	+0.440 to +0.659
	High Severity	+660 to +1300	+0.660 to +1.300
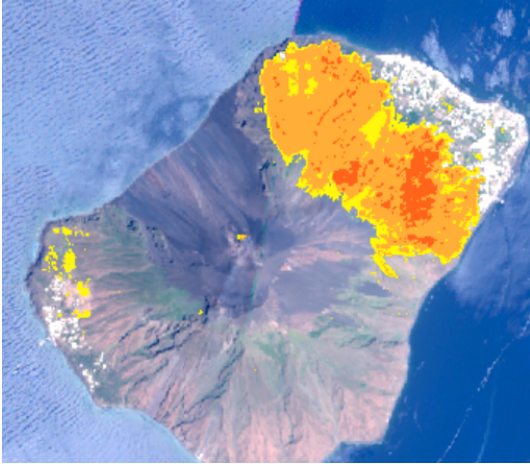
- Line 243: You state that the fire affected strongly to the vegetation of the island, bu,t in a few days, the vegetation consisting in Saccharum biflorum recovered, then, the effect on the vegetation cover was only momentaneous and, at the short scale, the effect was not strong. I would highlight the strong recovery capacity of this species. In terms of the effect on the vegetation, I would speak about the loss in area of native vegetation, due to replacement of *S. biflorum* caused by fire.

Does this alien species appear in abandoned agricultural fields only, not being able to enter the areas with native vegetation?

We will provide additional details on this points, including the loss in area of native vegetation

- Line 247: Was all the population of Cytisus aeolicus destroyed. How much remained?

Fortunately, only a small part of the population of Cytisus aeolicus went burned, corresponding to 3% of its area of occupancy (as calculated by Zaia et al. 2020).

- Line 254: It would be good to state here or in methods the frequency of the fire in this area. Do the zones with native vegetation have a different fire frequency than areas with S. biflorum?

Unfortunately, we cannot add details on this point, due to the lack of details on the fire frequency. However, we do not believe that native vegetation has a different fire frequency than areas with Saccharum biflorum.

- Line 275: You would need to give more evidence or an hypothesis explaining what conditions could lead to this replacement.

This is done in lines 273-274: "There is no data on the longevity of Saccharum rhizomes and related senescence processes, nor on the effects of volcanic ash deposition on rhizome burial"

Conclusions

- Line 293: I would not put this in conclusions but in discussion

We agree.

- Line 302: Although S. biflorum avoids erosion, it favours fire. Would not be better to directly sowing the native species or putting seedlings? And prepare the soil for them.

Yes, of course. But in sloping sites Saccharum recovers (and grows) faster than the native vegetation that, in the first stages after fire, is dominated by annual plants and young seedlings of perennial plants, with limited soil retention capacity.

The study is not put in a broader context, comparing its results with similar studies in other Mediterranean areas or around the world. They could also compare the situation in Stromboli with cases in other islands of the Archipelago that have been affected by fire. Following your suggestion, we will add a comparison to other studies in the discussion.

Citation: https://doi.org/10.5194/bg-2023-19-RC3