Forest SaVR – A Virtual-Reality Application to Raise Awareness of Deforestation

Jean Botev, Adriano Viegas Milani

University of Luxembourg
6, Avenue de la Fonte
L-4364 Esch-sur-Alzette
E-Mail: jean.botev@uni.lu

Abstract: Deforestation is a serious issue affecting climate and contributing to global warming. This demonstration presents Forest SaVR, an interactive virtual-reality application where users can explore a realistic forest environment to immersively experience the various stages and effects of deforestation.

Keywords: Deforestation, Environment, Virtual Reality, Serious Games

1 Motivation and Background

Deforestation and its effects on global warming and climate change are serious issues. They have been on the research agenda for many decades [SNS90, TIS96], however, the dissociation between people's knowledge of adverse effects and their lifestyles/practices [SBW15] presents a major problem. This detachment persists as recent numbers indicate, e.g., provided by the Yale Climate Opinion Maps [BLRR$^+$19] for the United States.

Interactive digital media in general [Ded09], and virtual reality (VR) in particular [BTS18], have a unique potential to close this gap, engage users in realistic environments and create immersive experiences that go beyond a mere factual representation of data. Experiential factors and the application of different storytelling techniques [HM14] allow to reconnect and reengage users with contexts that would otherwise remain abstract.

While there are several approaches to formalize experiential and game-based engagement in environmental issues, as discussed, e.g., in [OOLGPM19], to our knowledge there are no dedicated VR experiences concerned with the specific issue of deforestation. We therefore created ForestSaVR, a VR application that places the user in a forest environment to experience the various stages and effects of deforestation across realistic conditions.

Before describing the demonstration mode and intended setup in Section 3, we will discuss our implementation and some important design aspects of ForestSaVR related to environment generation in Section 2. We will then conclude with a brief summary and provide an outlook on future development of ForestSaVR in Section 4.

Veröffentlicht durch die Gesellschaft für Informatik e.V. 2020 in B. Weyers, C. Lürig, D. Zielasko (Hrsg.):
GI VR / AR Workshop 2020, 24. - 25, September 2020, Trier.

http://dx.doi.org/10.18420/vrar2020_2

2 Forest SaVR

The main goal of Forest SaVR is to deliver an experience as immersive as possible, and the different audio-visual aspects of the application discussed below are carefully tuned to provide a high degree of realism. For maximum effect and to offer an unhampered view, the user interface (UI) is kept minimal with any visible UI elements remaining hidden once the application is launched and the user enters the forest environment. The initial version of Forest SaVR is implemented using the Unity game engine together with an Oculus Rift headset and Touch controllers.

2.1 Forest States

The various forest states are shown in Figure 1, ranging from a perfectly intact forest (*healthy*) or state with only minor human interventions (*semi-healthy*), such as a road and a cabin, over a cleared forest (*burned* or *logged*) to a plantation setting (*cultivated*) with a nearby factory and an industrial plantation replacing the original forest altogether.

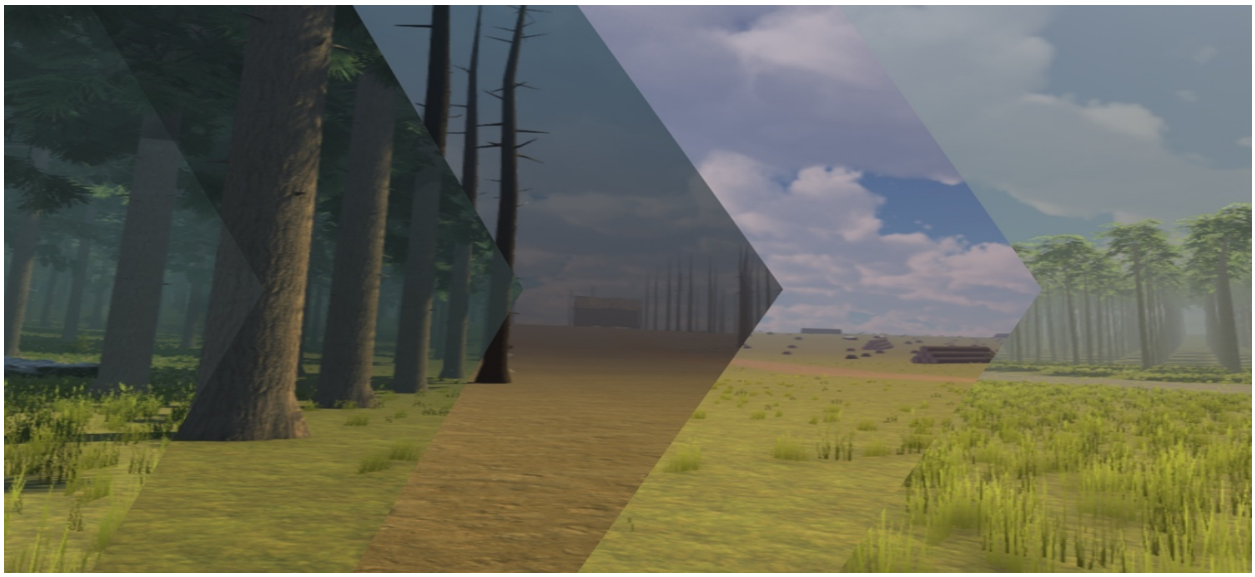


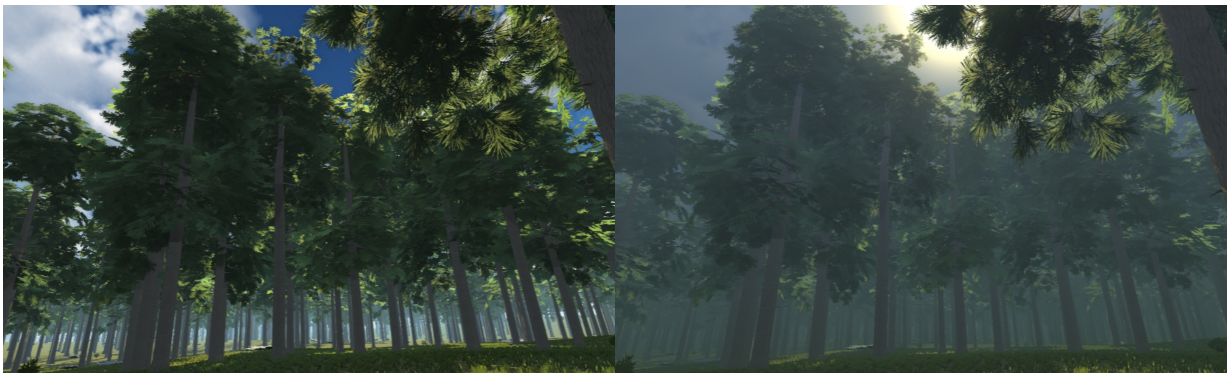
Figure 1: Forest states from healthy (left) over cleared (center) to cultivated (right)

2.2 Environment

Every time an experience is initiated, the terrain and environment are procedurally generated with semi-random tree/object placement based on Perlin noise in combination with different offset parameters for more organic distribution. Within each unique experience, this placement remains consistent across the scenes rendering the respective scenario, i.e., the states actually constitute multiple version of the same forest. This consistency allows for fluid transitions between states, as well as a higher degree of believability and immersion. The cultivated state (cf. Figure 1, right), where the forest is replaced by a plantation, obviously does not adhere to the initial object distribution; instead, it is characterized by the typical arrangement of the trees in regular intervals.

2.3 Lighting

The lighting conditions are an important contributing factor to any realistic VR environment. We therefore do not use the simple, in-built directional lighting, but opt for a more complex volumetric lighting solution with diffuse atmospheric light instead. The difference between these two variants is illustrated in Figure 2, where the same example scene of a forest is shown from identical perspective with standard directional lighting (Figure 2a) and custom volumetric lighting (Figure 2b), respectively.



(a) Directional lighting (b) Volumetric lighting

Figure 2: Example forest scene under different lighting conditions

2.4 Audio

Non-visual factors are equally important to the credibility and believability of VR-based environments, which is why each of the forest states is accompanied by selected ambient sound effects tailored to match and support the respective scenario, e.g., birds twittering or wind moving through leaves or gras. We support 3D audio with a dedicated source, directionality and related effects; however, as we are currently focusing mostly on the environmental experience, the audio is played back as 2D, i.e., directly to the listener with left and right stereo channels. To ensure both smooth playback and transitions, we integrated a dedicated audio controller component, as otherwise a continuous playback over scenes cannot be guaranteed.

3 Demonstration

In this demonstration, we would like to show ForestSaVR to an audience of VR professionals. The application is fully functional and running on at least one high-end mobile setup comprising a head-mounted display (HMD). For demonstration purposes, locomotion is restrained to controller-based input, so that a modest area for each active participant suffices. A video feed and other supporting material displayed on a separate screen complement the interactive HMD-based experience, so that visitors at the booth can easily follow and contextualize the current status of the demonstration during the event.

4 Conclusion and Outlook

This paper discusses Forest SaVR, an interactive VR application allowing users to dive into a realistic forest environment and immersively experience the effects of deforestation. This comprises different forest states ranging from healthy over cleared to cultivated.

The demonstration provides a first-hand impression to interested parties and potentially supplies important feedback to us for future versions of the application, which could be extended to include, e.g., the causal effects of deforestation on land erosion and animals. While it already constitutes a perfectly operational, immersive virtual environment, we are planning to develop ForestSaVR into a full-fledged serious game to further engage the users and sensitize players for this important environmental issue.

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